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Editorial

OUR RETIRING OFFICERS

After rendering valuable service to the Department of Agriculture, Central Provinces and Berar, some of its officers have recently retired from service and before the next issue of this magazine is released, a few more will have joined the list of retired officers. We wish these veterans of the Agricultural Department long life to enjoy their well earned rest.

To keep oneself fit, one must have some hobby. The necessity for this is felt particularly when one, who has been a Government servant, is suddenly relieved of those duties, which kept him busy for thirty years of his life at a stretch. We are told by some retired officers that they feel the "time hanging heavy on them," even more than the reduction of their incomes, by fifty percent or more.

For people, who have been serving in the Agricultural Department, there is "private farming" which should prove a congenial "pastime" and an "earn something" business. Their knowledge of Scientific Agriculture coupled with their experience regarding the agricultural practices in the country, should stand them in good stead. We are told that some of our retired officers are already busy negotiating for suitable land. We have no doubt that their farms will serve as excellent examples to the farmers

in the locality who, due to conservatism, want of education, and other reasons believe in examples more than precepts.

For those who have not the necessary fund of physical ability left in them, to take part in active agricultural operations on a farm, we are sure the "Village Uplift" (ग्राम सुधार) activity which we see buzzing all round, should certainly appeal to their interests. Retired officers have only to let the public know that they are open for consultation. Advice will be sought from them on various matters with gratitude.

There is another field of activity which we would humbly suggest to our worthy veterans. Writing on topics which had engaged their attention and energies during the best part of their lives should prove very fascinating when they have the necessary leisure for contemplation, retrospection, concentration and description. On subjects relating to the agriculture of a province or a district, it is from officers, who have worked in the province or the district that the public, who are interested in agriculture, should look for enlightenment, as they are best qualified to criticise and asses properly the time honoured practices, to which an unbending illiterate cultivator clings, on one side, and the recommendations made, by other agencies on the other, these last being based on broad scientific principles, the correctness of which cannot certainly be challenged, but the adaptability of which to local conditions, may be a matter of doubt. Our retired officers will be helping their junior successors in no small degree if they will make their knowledge, relating to such controversial questions pertaining to the countryside, available for them.

Another very great service, that can be rendered by retired technical officers, which might also bring them a reward financially, is the translation of books and articles, on their own particular subject, into a language of their people, be it Hindi, Marathi, Tamil or Urdu. Mahatmaji has himself pointed out, in his article on education, the great advantages of teaching and learning in a vernacular. These cannot be denied. A few technicians

are inclined to strain the language difficulty. With a public spirited educated class however, there should be no language difficulty. In the same article Mahatmaji points to the example of Great Britain, where it is claimed and justly so, that there is no book or writing; worthy of any consideration at all, published in any language, of which there is not an excellent and accurate translation in English, available for sale, within an unbelievably short time.

Undoubtedly one of the greatest obstacles to effective propaganda of the type that this Department of Agriculture so desires to succeed, is the very great scarcity of really suitable technical or modern literature, in simple form, in vernacular or regional languages. One of the simplest ways of overcoming this trouble, is by translations, and who are better qualified to produce the translations, than retired officers of an expert technical service! In this work they would not only be blessed by the few, but by their whole land.

Our retired officers can also be of immense service to the students of the College of Agriculture, by giving correct descriptions of the raising of crops, variations in agricultural practices, (like rotations, planting methods,) costs of cultivation, etc. For information regarding such details, the staff of the College of Agriculture has naturally to look to the officers of the Department, working in the different parts of the province, closely in touch with the farmers and the Government seed and demonstration farms. Dissemination of such valuable information cannot be better done than through the pages of this magazine. Officers of the Department with their multifarious duties have been too busy to spare some time to enrich the pages of this journal, with such material. Otherwise, our frequent appeals to them would have been given at least some consideration. We hope that at least officers who have retired and may seek an outlet for their energies will not grudge to do this service, which we earnestly solicit.

Original Articles

THE BOLLWORMS OF COTTON IN THE CENTRAL PROVINCES AND BERAR

By Rai Sahib G. R. Dutt, B. A.,

(*Entomologist to Government, Central Provinces and Berar*).

Three types of Bollworms.—There are three types of bollworms, viz. the Spotted bollworm (*Earias fabia.* Stoll.), the Pink bollworm (*Platyedra gossypiella* Saund.) and the American bollworm (*Heliothis obsoleta*, Fb.) which attack the cotton crop in this province. This crop is sown generally in the last week of June or in the first week of July with the earliest showers of rain, and becomes ready for picking by the latter half of October or early November. Pickings generally continue till the end of December but in exceptional seasons they may prolong to the end of January.

The Spotted Bollworm.—The Spotted bollworm makes its first appearance in the crop in the last week of July when the plants are from six to nine inches in height. The larvae bore into the shoots which droop down and wither. Later when the flower buds and bolls appear these are attacked. The young larva enters the bud or boll and feeds on the contents. The affected forms drop off the plants on being shaken by wind or artificial means, but the big sized bolls do not shed even if severely attacked.

The pest appears in the new crop late in July, and its multiplication is checked by heavy showers of rain during August and September, but with the cessation of monsoon in October it multiplies rapidly so long as the crop remains in the field. It reduces the yield of *kapas* by damaging flower buds, young and developed bolls, stains and weakens the lint and spoils the quality of the fibre. In the *kapas* of the whole season 16 percent partly damaged and 4 percent completely damaged locks can be attributed to this pest.

The Pink Bollworm.—The larvae of the Pink bollworm appear in this crop in very small numbers in the latter half of September, but the number gradually increases and reaches its maximum in the month of January when cotton is almost harvested in this province. Unlike the Spotted bollworm the Pink bollworm larvae prefer bolls to buds and tender shoots. Although it is a very serious pest of cotton elsewhere yet the damage caused by it in this province is much less than that caused by the Spotted bollworm. In the *kapas* of the whole season about 3 per-

cent partly damaged locks and hardly 1 percent completely damaged locks can be attributed to this pest.

The American Bollworm.—The larvae of *Heliothis obsoleta* appear in cotton fields, in small number, towards the end of July when they feed on leaves and tender shoots. The pest gradually multiplies and becomes abundant from the beginning of September to the middle of October during which period it attacks severely flower-buds and bolls. These are bored by the caterpillar and the contents are clean devoured. The damage is complete. Bolls which are tender and succulent are much preferred to those that are matured and hardened. Owing to this habit of the pest no damaged locks which can be attributed to this pest are found in the harvested *Kapas.*

From the above it will be seen that the Spotted bollworm *(Earias fabia)* remains active in cotton fields throughout the season and causes a considerable amount of loss in the final yield of *kapas.* The American bollworm (*Heliothis obsoleta*) joins the former during the bud and boll development stage for six or seven weeks and on account of its voracious feeding habit causes in this short period no less damage than the Spotted bollworm. With its disappearance towards the middle of October, the Pink bollworm (*Platyedra gossypiella*) associates itself with the Spotted bollworm but due to its slow rate of multiplication and feeding habits it is not considered as a serious pest of cotton in this province.

The increase in yield in the absence of Bollworms.—In order to estimate the increase in yield in the absence of bollworms, 48 plants were protected by the 'Night caging' method at Nagpur and a similar number was kept as control. The plants completely protected from damage by bollworms produced 27 % more pickable mature bolls than the plants which were open to bollworm attack. The increase in the final yield of *kapas* from protected plants was 51 % higher. When these experiments were repeated next year at Akola the increase in the final yield was 49.6 %.

Life history of the Bollworms.—Regarding the life-history of these bollworms in the Central Provinces, the following facts have been ascertained. The maximum number of eggs laid by a single female of the Spotted bollworm is 592 and the egg stage lasts from 3 to 5 days. The larval stage varies from 15 to 18 days during December—January and from 10 to 14 days during other months of the year. The pupal period is of 16 days duration during the cold months and of 9 days during the rest of the year. It does not hibernate or aestivate but breeds continuously when food is available.

The maximum number of eggs laid by a single female of the Pink bollworm, so far observed is 346, and the incubation period is 4—5 days during all the months of the year excepting December and January when it extends upto 7 days. The larval period during July to the end of November is 10 to 14 days, during December January it is 14 to 22 days. From the middle of November a few larvae enter into long cycle stage. The pupal stage lasts for 7 to 9 days throughout the year excepting in December—January when it occupies 10 to 12 days.

The life-history of the American bollworm has been studied for one season only and the facts which have been collected concerning it have to be confirmed by further observations before they can be published.

The "Carry-over" problem.—In this province the last picking of cotton is generally finished by the end of December and in exceptional seasons it may extend upto the end of January. The new cotton crop is sown in the last week of June or in the first week of July according to the condition of monsoon rains. Thus there is a clear span of 5 or 6 months between the close of one season and the commencement of the next one. It is of importance to know how the bollworms bridge over this critical period and reinfest the crop of the new season.

The cotton plants are allowed to stand in fields long after the last picking is over. They put forth fresh growth and numerous buds, flowers and bolls are found on them till the end of April. The Spotted and the Pink bollworms breed in them. In several places in Berar the plants are intentionally allowed to stand in fields till the end of April for picking the *kapas* of the second flush and this secondary picking is known as *Faldari* picking. The cotton fields are cleaned by the end of May or the beginning of June. Thus the food for the Spotted bollworms in cotton fields becomes rare in May and is completely absent in June. But in localities where there exist tanks and wells for irrigation, cultivators generally maintain a fruit or vegetable garden; and in those gardens the Spotted bollworm finds alternative food plants such as *Hibiscus esculentus, H. panduriformis, H. cannabinus*, Hollyhock, *Abutilon*, perennial cotton trees etc. to carry on its existence through the critical period. Again in big towns like Nagpur, *Bhindi* pods are imported in fairly large quantities from far off places outside the province during June—July, and these pods are sometimes badly infected. Due to traffic facilities they are sometimes taken to the interior also. The moths which emerge in July from the affected pods find young cotton crop, on which they lay eggs.

After the close of the cotton season some of the Pink bollworm larvae are found in cotton seeds, some in *kapas* of late pickings or in *kapas* which remains on cotton sticks stored as fuel, some are found in cracks in the soil, and moths from all these emerge during June—July when reproductive forms on plants in cotton fields are not available for oviposition.

The stray volunteer cotton plants and tree cotton plants, however, harbour many Pink bollworm larvae during these months, but the number of such plants being very small they are not capable of supporting pink-bollworm population to an extent which will cause heavy infection of the new crop. The number of the larvae being small in the beginning of the cotton season and the rainfall and available food conditions being unfavourable, it takes the pest a long time to multiply to an appreciable extent. However, these few plants keep the pest alive and help it to bridge over the critical period between the close of one cotton season and the beginning of the next one.

Control methods.—It is an established fact that cotton buds, flowers and tender bolls when attacked by bollworms drop off the plants on receiving the slightest jerk. Even the breeze which shakes the plants gently is enough to cause shedding of the affected forms. It is also a well known fact that when the shed forms begin to wither and dry the bollworms larvae leave them and get into the plants near which they happen to lie. If there is a heavy shower of rain the larvae inside the shed forms are killed, as the forms get more or less drowned. If therefore the shed forms are systematically collected and destroyed early in the morning when there has been no rain during the previous night, the crop is bound to be benefitted, as the number of bollworms will be considerably reduced and the succeeding broods will be checked to a great extent. This method was tried during September—October in 1935 and 1936 and gave satisfactory results.

The study of the "Carry-over" problem has shown that in this province the bollworms are carried over from one season to the next one through the help of alternative food plants such as *Hibiscus esculentus*-*H. panduriformis*, *H. cannabinus*, *Abutilon* spp. Hollyhock perennial tree, cotton etc. growing in gardens. If "Clean up" measures against these food plants are vigorously adopted in garden areas, the cotton crop of this province is bound to improve considerably.

RURAL UPLIFT

K. R. NARAYAN SINGH, L. AG.

(*Director of Agriculture, Jhalwar State*).

It is a settled propositon that the rural population is far behind the urban in every sphere of life; social, physical, mental and economic. It is not the case of the local disease that can be cured by a bandage here or a liniment there, but it is that of a general break-down which needs an allround improvement.

There is a simple prescription of four medicines, which if properly administered, is sure to give a radical relief to the four above ailments :— (i) Education, (ii) Co-operation, (iii) Sanitation and (iv) better cultivation, are all that are needed for the amelioration of the poor condition of the rural masses. The disease once diagnosed and the prescription got, how it should be administered is the task before us. As far as social improvements are concerned, we have to impress upon the cultivators the value of thrift, the evils of intoxicants and early marriages, the advantages of female education, the dire results of borrowing, and the benefits of co-operation. For physical improvements we have to impress on them the advantages of sanitation and hygiene and raise their general standard of living, provide facilities for cleaning their wells, roads and surroundings, arrange for maternity and child welfare, and teach them how to take precautionary measures against simple diseases by giving them medicine boxes for human as well as cattle diseases. We will also have to arrange for their play-grounds, encourage games, organise clubs, reading rooms etc for them. Unless their sense of decency and cleanliness is awakened, it is futile to expect much progress in making their villages cleaner and healtheir than they are today. Mental improvement can be effected by education which should be more technical and pertaining rather to their profession than be literary in character. For economic improvements methods should be adopted that increase their receipts and reduce their expenses. A marvellous change has been brought about by scientific researchs in every art and profession. All that is needed is to bring it home to the cultivators.

One thing that both study and observation bring forcibly to the mind, is the general poverty of the villagers—poverty of information as to how their conditions could be improved and poverty in material

resources to secure those things which could make their occupation more profitable. Sufficient material is available to ensure improvement of the general condition of the rural population. We have only to impress upon the villagers the necessity of adopting them. But to persuade a cultivator to agree, to part with his old customs and practices is to revolutionise the man bent double with the weight of his prejudice and age-long conceptions. His poverty, ignorance, illiteracy and conservatism fill him with all sorts of apprehensions. The main object, therefore, is to make the villagers understand the utility and efficiency of the suggested improvements. Agencies deputed for rural uplift will have to work hard and with patience and tact. If every worker bears in mind the following points his efforts are sure to be crowned with success :—

1. He should not only be familiar with those whom he has to serve but should gain their confidence.

2. He should study their needs and difficulties and find out remedies.

3. A thorough knowledge of the local conditions is essential before any suggestion for improvement can be made.

4. He should not impose reforms on the villagers but should work with them from within.

5. He should secure help from the local Zamindar and should try to work with co-operation with him as his influence is calculated to ensure speedy success.

6. He should not go to any village as an officer but should meet the people as friends rejoicing in their pleasures and sympathising with them in their sorrows. Only then will an atmosphere of love and friendliness be created instead of a feeling of awe with which an officer is invariably looked upon by a villager, and nothing can be achieved.

7. All such recommendations as may be suited to the locality and be found to be within the means of villagers, should be tried.

8. A villager is not so conservative as he is said to be, but surely he is too poor to take any risks. Actual demonstrations with substantial financial gain either in increased yield or in decreased expenses are the best methods of convincing him of the advantages of what you recommend.

9. Guide the villagers intelligently. Try to enlarge their mental horizon and make them conscious of their own potentialities.

10. Whatever demonstrations you have in hand you should do them thoroughly and successfully. It is better not to do anything at all than doing it in a way which does not appeal to the villagers.

11. You should concentrate on your work in the centre of a big tract. It will afford better facilities for supervision and subsequently will form a neucleus for development in the neighbouring villages without any special effort on your part.

12. You should make the villagers understand that better farming is more profitable than big farming. A small area properly ploughed, heavily manured and sown with improved seeds, is far better and more productive than carelessly cultivating a far larger area that cannot be properly managed.

13. The villagers should be made to understand that they are not happy because of their old methods of farming, their being victims to diseases due to insanitary and filthy dwellings; that their poverty is due to their own illiteracy and want of knowledge of the scientific improvements in their profession; that they are unhappy because their children are unhealthy and they waste much of their money in litigation and bad social rituals, and keep their women-folk in degradation paying no attention to bettering themselves and their surroundings.

14. Impress upon the villagers the value of co-operation which cements the structure of development. A great deal of litigation can be avoided if a spirit of co-operation is made to prevail and substantial all round improvement can be effected by joint efforts.

15. You have to so educate the villager as to metamorphose his entire outlook in life and to make him develop an impulse for self-improvement, social, mental, physical and economic. The villager's extraordinary apathy towards improvement must be fought and conquered by investing him with a new outlook in life.

You must convince the people of their capacity of achieving more than what they have so far achieved and create among them the desire for better living which will make them pay heed to new ideas and new methods of increasing wealth.

The above are a few important hints which are calculated to bring about rural uplift, a state of things which has been recognised to be essential for the welfare of the masses. For this purpose a lot of material has already been got ready which, if applied with care, will do all that is needed.

THE POSSIBILITY OF GRAPE CULTURE IN THE NIMAR DISTRICT

By M. C. Gangarade., B. Ag. Class.

Introduction.—The cultivation of grape vines is an old art for Indians. We were growing grapes from centuries. We find frequent references of grape fruits and alcoholic drink prepared from grapes known as 'Drakshasava' in our religious as well as Ayurvedic books. There was a time, when grape growing reached its zenith in certain parts of the country, but later on its cultivation declined owing to political changes and perturbed conditions which were prevailing during the last two centuries. In the present century, we find a sort of awakening among the horticulturists to revive the old art of grape vine cultivation, the fruits of which are so very beneficial. In this article, I have attempted to discuss the possibility of reviving grape-growing in the Nimar District of this province, which was once renowned for its grapes.

Historical evidence of grape growing in the district.—History reveals that during the 16th and 17th centuries, and even up to 18th century, Asirgarah which was the gateway of the Deccan had innumerable vine-yards. In the Nimar District Gazetteer Mr. C. G. Leftwich writes, "There used to be in the days of Farukis and Mughals extensive vine yards round the base of Asirgarah, their culture still survives to a small extent which is on much reduced scale." The other reference, we get, is in the book named, "The Hand Book of Gardening in the Central Provinces," which was published in 1880. In that book Major J. W. MacDougall writes, "Grape-vine does not succeed well in the province except in a tract in the vicinity of Burhanpur in the Nimar District. Here the variety cultivated is the white kind, the fruits being round in size, somewhat small and hard."

The above mentioned references indicate that forty to fifty years ago, vine cultivation was properly attended to by the people, but it gradually lost the interest of the cultivators due to various reasons, but now the time has come, when it will be quite justifiable and profitable to begin its cultivation again. We will consider its possibilities from the following aspects :—

(i) Climate. (ii) Soil. (iii) Technique (iv) Marketing and (v) Capital.

General situation of the district.—The Nimar district is situated between 21°5' and 22°25' North (Latitude) and 75°57' and 77°13' East (Longitude). The district occupies a strip of mixed hill and plain country

at the western extremity of the Norbuda valley and the Satpura plateau. The elevation of the plain varies from 800 to 1200 feet above the sea level. Asirgarah is 2204 feet high. The average height of the central plateau comes to 1600 feet above sea level.

Rainfall.—The average rainfall of Khandwa for 39 years is 31″ and at Burhanpur 32″. This rainfall is the lightest of any district in the Central Provinces, but exceedingly adopted to autumn crops. The relative humidity varies between 50 and 60.

Temperature.—The average, mean, maximum, and minimum temperatures during the selected months are as follows:—

	Maximum	Minimum	Mean
1. January	84°F	52°F	67.5°F
2. May	106.5°F	81°F	93° F
3. July	87.5°F	75°F	80.5°F

Climate in general.—The climate of the district is fairly healthy and pleasant throughout the year on account of its elevation and position. The lower portion of the Norbuda and Tapti valleys are much hotter than the higher plateau of the central Nimar on which Khandwa stands. The extensive tracts of forest lying to the west, in the course of the prevailing winds keep the atmosphere cool and clear. During breaks in the rains and the monsoon, the season is pleasanter in the Nimar District than in most of the other districts. The cold weather, though not bracing, is distinctly pleasant and lasts from the beginning of November to the middle of March. The hot winds, usually begin about the middle of April and blow steadily from the directions North-west and West.

When we compare the above mentioned climatic features of the district with the grape growing districts of the Bombay Presidency, we find that;

1. Two seasons, one winter and one summer are ideal for grapes; this we find in the district. 2. Rains and cloudy weather in the fruiting period, are injurious; dry weather from the end of October till the end of March is essential for the healthy growth as well as for fruiting of the vines. 3. Rainfall heavier than 40″ is likely to make the vine run more to vegetative growth than to fruiting. This district, very rarely gets rains in winter. Generally the winter season is dry and clear. The total rainfall seldom exceeds 40″. These are the ideal conditions for grape growing.

4. Warm dry winds during the ripening of the grapes i. e., October and April accompanied by bright sunshine and absence of clouds are most favourable. Temperature ranging from 102 to 105°F in the shade has been found suitable in different grape growing localities. These conditions are very well found in Nimar.

5. If the cold season coincides with the fruiting period as happens in the Deccan, a little care is to be taken, but the crop is likely to be destroyed if the temperature falls to freezing point. A continued spell of low temperature delays the maturity of the fruit.

So, we find in the Nimar district the cold season lasts from November to middle of March. The temperature in winter season never goes below 50 to 45°F, therefore, this district is quite congenial for grape vines.

Soil.—The grape vines will thrive on a great variety of soils. There are thrifty vine-yards on the light, deep valley loam, on the heavy clayey loam and on the foot of hills. Even on shallow soil the grape will do well. Standing water during the active period of vine, is however, unfavourable for growth. Almost any soil which does not hold excess of water or is not tainted with alkali will do for the vine. The soil of the district is derived from the trap rocks.

They are called by the following local names: —

1. **Gata.**—It is a low lying, moist black soil, not well drained, hence unsuitable for grape growing..

2. **Thowar.**—It signifies level land of good deep soil and well drained. It is sufficiently fertile and better suited for grape vine.

3. **Mal.**—It indicates land lying on a slope. There are three divisions of it, Mal I, Mal II and Mal III. Out of these Mal I and Mal II are well suited, because they are well drained and the soil is half to one foot or more deep, sufficiently rich in organic matter to support vine.

4. **Alluvial soil.**—It is on the banks of rivers which are generally more open. It suits grape vine very well; therefore the alluvial valley of the Tapti round about Burhanpur is typically good. The plateau soil near about Asirgarah is the best of all. It is fertile as well as well drained and fulfils all the requirements of vine growing.

Irrigation.—Grape vine is a deciduous plant. It is very hardy. It has got a vigorous root system, which obliquely penetrates deep in the soil.

After many years of experience cultivators of Nasik have come to the conclusion that after April pruning the vines require not more than three heavy irrigations. After October pruning, when berries are of the size of pea, the water supply is gradually to be increased. It reaches its maximum in the months of March and April, when it is the time for the harvest. During this interval not more than ten waterings are needed. In all it requires 15 to 16 irrigations in a year.

This, however, can be managed in the district. The irrigation can possibly be done by wells, as canals and tanks are quite out of question here. The depth of the water level varies from 15 to 20 feet below the surface. The mhotes and rahats are the two contrivances, by which water can be taken out economically from the wells, hence the cultivators can manage for the irrigation.

Technique.—The enthusiastic and rich cultivators should employ some expert malies from Nasik and other places where grapes are grown extensively. The agricultural societies should carry out this movement with great zeal by distributing leaflets, bulletins and books pertaining to the subject. They should also arrange meetings of the cultivators to explain the proper methods of cultivation. In this way, within a short-time sufficient propaganda will be done and the cultivators will soon learn the technique.

Labour.—Labour is available in plenty in the district, and their wages are quite cheap. Men coolies are paid three annas each per day, while female coolies are given two annas per day.

Labourers are chiefly required at pruning time which also synchronises with other operations in grape plantation. The pruning is done twice in a year, first in April, when the labourers are quite at rest and can be had in abundance, while second pruning is done in October at which time grass cutting will be in progress in the district. When the grapes mature a number of watch-men are required to scare away the birds which are a great nuisance during the ripening time. In addition to the local labourers, there is an influx of hundreds of them from Hoshangabad, Bundhel-khand, Cawnpore and Pratapgarah districts. Thus there is sufficient supply of labourers to meet the demand.

Marketing factors and transportation facilities.—There are waiting markets for grapes in the Central Provinces and Central India, as the supply is very limited. We see that Nasik grapes are transported as

far as Calcutta, Rangoon and other remote parts of India and Burma. Similarly grapes of this district can be sent to the markets of Hoshangabad, Jubbulpore, Narsingpore, Nagpur and in Central India, markets of Mhow, Indore, Gwalior which will receive the grapes of this place with pleasure. There are two railway lines. The Great Indian Peninsula runs through the heart of the district, while the Bombay Baroda Central India Railway connects Khandwa and Ajmer. There are several metalled roads also, which communicate with the small centres. Thus rails and roads form a net work and there is no apparent difficulty in the transport of the harvest.

Capital.—To start a grape vine plantation, one has to invest money initially; but it becomes a paying concern very soon. Grape vines from the second year of their planting begin to give a little income. In the third year, the income is nearly equal to the expenditure of the plantation while from the fourth year a cultivator can easily save a surplus. The total annual expenses per acre amounts to Rs. 1,100. The outturn generally at the ordinary rate is above Rs. 1,600 to 1,700. Thus, there is an evident profit of five to six hundred rupees.

The age of the plantation largely depends upon the care that is taken in manuring, pruning and irrigation. A grape plantation can very well bear fruits up to 40 to 50 years. In Nasik, there are some plantations that are 25 to 30 years old, but they are in satisfactory condition and there is no difference in their yield. Ordinarily, we can limit its age between 30 to 40 years.

Conclusion.—After scrutinising minutely and finding all the factors favourable, it is the duty of the well-to-do malguzars and cultivators to give an initiative to such a paying and prosperous enterprise. The enthusiastic cultivators should leave no stone unturned to introduce grape culture which is sure to bring health, wealth, vigour, and employment in the district.

SUMMARY

1. Nimar district is just situated near the grape growing region of the Bombay Presidency.

2. The climate of the district favours grape cultivation.
3. Soil is quite suitable for irrigation and other cultural operations.
4. There are ample facilities for transportation and marketing.
5. There is no scarcity of labour.
6. There are malguzars, cultivators and baniyas, who can invest money for vine-yards.

REFERENCE

1. The Nimar District Gazetteer.
2. "Grape culture in Western India" by Sohrab. R. Gandhi M. Ag.
3. "Draksha Cha Bag" by H. V. Gole.

KNOL KHOL

By Dhannalal, L. Ag.

Botanical Name.—Brassica oleracea.

Natural Order.—Cruciferae.

Vernacular name.—Gatta Gobhi.

History.—Knol khol is one of the most peculiar type of vegetables. This is a variety of cabbage whose stem swells up into a fleshy mass which forms the chief edible part. It is believed to be a native of Germany. This variety as the name indicates is probably a native of India where it is grown in the rainy season. The plant can withstand both types of climates found in India but cold one is the best. Its cultivation does not date back very far in the history of foreign countries although all the countries having a cool climate grow it abundantly. In England it is not grown on a large scale as a table vegetable but there it is used as a substitute for turnips and often fed to the cattle. In C. P. it is grown largely near about cities and towns.

Season.—It thrives best in cold climate and hence it belongs to rabi season. It is due to this very reason that it has been named as Khol Rabi to distinguish it from other varieties of cabbages.

Varieties.—There are several varieties but the following two kinds are most generally grown:—

(a) Sutton's Earliest white. (b) Short-Top green.

Soil.—It requires a good friable soil. Light loam is the best for cultivation. It may be grown in heavy soil provided enough organic matter is present in the soil.

Manures and fertilisers.—The suggestions made for cauli-flowers are applicable to knol khols.

Cultivation.—The land requires to be carefully cultivated till a deep tilth is obtained. This requires ploughing and a number of

bukherings. When the necessary tilth is obtained the land is laid out in beds and ridges and furrows by means of E. T. plough or by hand labour according to the system of irrigation and the lie of the land. A most useful form of laying out the land is to run the channel down the highest piece of land and run the ridges and furrows about ten feet at right angles to these irrigation channels.

Sowing.—Early knol khols are planted in the month of November while late transplanting is generally done by December. Early transplanting is desirable to catch early market. The seeds should be sown broadcast in beds from the middle of August to the beginning of September and the young plants when 3″ to 4″ high planted out in the field prepared for the purpose. In order to have a succession of succulant stems, sowing at intervals of a fortnight should be made.

Subsequent operations.—All further attention is confined to weeding when needed and watering once in 10 days when the weather is dry.

Irrigation.—The first watering should be applied immediately after transplanting. Subsequent waterings are given after 10 days or so and are each followed by weeding and mulching until the plants are well grown.

Harvesting.—The crop gets ready within two months and the harvest lasts for about a month or so. They are harvested with the help of sickle, the proper time being that when the diameter of the swollen stem reaches 2—2½″ which generally comes off in four or five months. They are pulled out and the stems pared off just below the swelling. The stem soon becomes tough and woody if permitted to develop further.

Yield.—It varies from 10,000 to 13,000 number of heads per acre.

Cost of cultivation and net profit.—It is more or less the same as given for cauli-flowers and cabbages in the previous issues.

A SIMPLE METHOD OF EXTRACTING FIBRES FROM LINSEED STALKS II

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In a previous publication of this magazine (Vol. XII No. 3, 1938) an account of a process for extracting fibres from linseed stalks was given. The process consists in retting the stalks for nearly seven to ten days followed by breaking the dried straw with mallets. This method is of general application and can be employed in extracting fibres from both broken as well as unbroken stalks.

With a simple machine (a type of breaker) shown below, the fibres from the unbroken and retted stalks can be extracted more economically. The broken straw cannot be put through this model.

Fig. I shows a diagramatic sketch of a machine referred to above. The actual dimensions of the various parts can be calculated from the scale shown in the figure. The working of the model is seen in Fig. II. The machine is very simple in construction and can be easily prepared by village carpenters. It is made of either strong and hard wood or iron. The latter has no special advantage except for its durability. A labourer in a working day of 8—9 hours can easily extract nearly fourteen pounds of fibres. It is very essential that the retted stalks are completely dried before putting through the model.

The fibres so extracted contain a certain amount of woody matter. They are, however, quite suitable for all agricultural purposes.

The quality of the fibre can be considerably improved if the stalks are retted in running water and afterwards thoroughly dried before putting through the machine.

Thanks are due to the Imperial Council of Agricultural Research for financing the scheme to conduct research on important oil seed crops grown under black soil conditions.

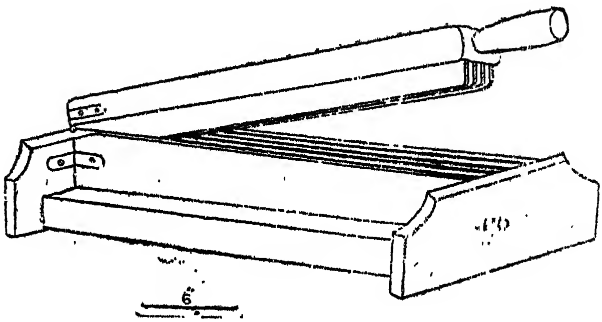

FIG. I. A diagramatic sketch of the model used in linseed fibre extraction.

FIG. II. Working of the model.

FACTORS AFFECTING CROP-GROWTH IN INDIA

By D. R. Dhodapkar, M. Sc., B. Ag.

The wide extent of our country, embracing tropical and sub tropical climate coupled with the large number of rivers running across the land, affords immense possibilities for growing crops of varied nature. But what appears to be a distinct advantage is also a factor in presenting difficulties of equally varied nature in the production of crops. It is this tropical character of our land that is responsible for the uncertain nature of the climatic factors and environment. It is a matter of wide knowledge that the cotton cultivator does not feel sure of his good crop unless the produce is brought to his home.

In a tropical country like India, there are two types of crops that are raised by the cultivator viz., Kharif and Rabi. In the Kharif season, the advantage of the natural water supply in the form of rain is taken and crops such as rice, cotton, juar etc. that can withstand the peculiar conditions of the monsoon are grown by the farmer. But the uncertain nature of the rainfall introduces a factor of grave risk for the cultivators. Not only that yield depends upon the total amount of rainfall received but that it also depends upon the nature of the distribution of the same during the growth period of the crops. It has been the experience of the cultivator that if the rainfall is evenly distributed a good crop of cotton can be had with much less rain than we actually receive. In fact a rain amounting to few cents in the night and a bright sunshine during the day is, perhaps, considered as an ideal condition for growing cotton. In case however the rainfall is ill-distributed, it is sure to result in the total failure of the crop. So also the crop can thrive under heavy rains, if only it is properly distributed, so that the soil may get rid of the water in proper time. On the other hand, if the heavy showers pour down untimely the crop is washed away.

Many times, a heavy rain in the beginning of the season causes the seed to be washed away and if the cultivator is unable to resow the crop due to unfavourable weather, he is required to pass the whole season without any Kharif harvest. He has then to see to the possibilities of taking a Rabi crop. At other times, there is a shortage of rain after the seed is germinated and consequently the young seedlings die of thirst. There are equally grave risks of damage if there be heavy rains during the growth-cycle of the crop. It may produce water logged condition in the soil, which will effect the aeration and the root-development. This will have an adverse effect on the tillering and crop growth, for a strong root-development helps tillering in the plants (Parr)[5].

In the Bombay Presidency, it has been often found that during the formation of cotton bolls, there is a heavy demand of water by the plant, which the soil lacks in. This results in the shedding of the bolls, whereby there is a heavy loss in the outturn. On the other hand if the rain is heavy or the temperature is high, it also results in the shedding of bolls. It is for these various reasons that high yields in the Gujerat cottons depend upon the sowing of a variety that should not flower before the fifteenth of November and at the same time should end flowering before the end of January (Patel)[6].

Even if the crop is safe during the growth period, there is a danger of later rains spoiling the same. In case of late rains, cotton fibre is stained and thus its value is lowered, while Juar grains sprout thereby causing a heavy loss in the outturn.

In addition to the difficulties stated above, the cultivator has also to see that he keeps the crop free of other vegetation. The conditions being particularly favourable for the growth of vegetation in rainy season, the crop many times suffers from plant competition in the field. The operation of weeding is a substantial item of expenditure in the cultivation of Kharif crops in India. So also care has to be taken that the land is cleaned of all vegetation in order to enable us to sow Rabi crops. This is of particular importance to crops, like linseed, which require a clean land and the tilth of the finest, deepest and cleanest nature.

Secondly the rainy season is followed by the winter which sets in by the middle of October. This puts a limit to the growth of Kharif crops. Particularly in India this has handicapped the cotton cultivator very seriously, since he is not able to sow cotton of long staple. The consequence is that though the production of Indian cotton is in large quantities it does not find any market. The result is that it is sold at a ridiculously low price and the Indian Mill-owners are required to import good quality cotton from outside for the manufacture of cloth of fine texture. It is this huge surplus of short stapled cotton that has been the cause of the failure of the recent Anglo-Indian trade agreement at Simla.

Apart from the difficulties mentioned above, it may be pointed out here that the rainfall received by the soil affects the concentration of the soil solution. This has an effect on the amount and the nature of aborption of different elements by the plant (Stiles and Kidd 1919[7]). The nature of the food available to the plant has an effect on the growth and quality of the crop (Vishwanath[10]). In many cases, this is of great

economic significance. For example, in canes the resistence to drought depends upon the concentration of the cells-sap. The juice of low osmotic concentration is very sensitive to drought, while the one with very high concentration is quite resistent. The concentration of the cell-sap depends upon the physiological relationship between the plant and the soil and is more or less independent of the genetic composition of the seed. Also the induced changes affect the composition of the plant-body. This change in the composition of the plant-body obviously may give room for entrance to any pest, for there is a perfect correlation between the condition of the host and the incidence of the diseases. Many insects and fungi are able to make their way into the plant only at a particular stage of plant development. For example, in the Madras Presidency the paddy Stem borer (Schoenobius Incertellus) is able to infect the host only at a younger stage of growth, but if the growth of Paddy is accelerated by the use of ammonium sulphate the damage is greatly reduced. Even with the best seed, a good growth of crop is possible only with the most favourable environment. But as Balls[2] points out, it is too generally accepted that a control of seed supply is equivalent to a complete control of quality, though not of yield. Also in order to withstand the attacks of pests, a vigorous growth of plant is absolutely necessary, which is possible only under favourable conditions of environment.

So far we have said only of Kharif crops but the amount of rainfall and the nature of its distribution has an effect on the growth of Rabi crops also. The level of water in the soil, wherefrom the Rabi crops draw their water-supply depends upon the rainfall received. In the year 1918-19, the area under Rabi crops in the Central Provinces and Berar actually fell down as sowing could not be done due to drought. In case there is a long break between the last rains received and the sowing time, the water level in the soil goes very deep and the young plants are not able to reach them. This may then result in the failure of the crop, unless the conditions are improved by a timely watering. Even when the water level does not go deep at the sowing time, the effects of water shortage may be felt during the later stages of plant growth. Thus in order to be sure of the success of the crop, a source of water supply is absolutely essential. In case of wheat the milling and baking qualities are affected by the soil, the nature af the season and the water supply.

Great consideration has to be used in the sowing and the cultivation of canes in the tropics. It must be sown so as to mature either

before winter or late in March. This is necessary because cold has an effect in the lowering of the quality of the juice. Secondly, it is subjected to violent changes of temperature and so the variety sown must be capable of withstanding the same. (Taylor[8])

In a crop like linseed, which is very sensitive, a slight change in the weather conditions is sufficient to affect the crop growth. So also there is a danger of hailstorm spoiling the crops, as it happened to crops in Central Provinces and Berar in the year 1935. In case the weather is cloudy, there is the danger of the attack of rust and other diseases.

The protection of the seed from the effects of heat in summer is a problem of major importance. Though not apparently coming under the scope of the present discussion, it has a direct effect on the crop growth. The summer temperature in India many times goes above 112°F and thus accelerates the respiratory activities in the seed, which leads to loss of vitality and detorioration of the same. So also the seeds have to be protected from damage by moisture in the rainy season. Seeds with higher percentage of moisture lose their germinating capacity sooner than well ripened dry seeds. Not only that plants from good seeds are more productive but the extra vigour of the same keeps under control any attacks by the fungi, which are constantly present in the soil (Dastur[3])

In India, the crop is naturally exposed to drastic variations in a large number of climatic factors such as rainfall, temperature, light etc., But so far as the Kharif crops are concerned rainfall appears to play an important part in the growth of crops, all others being determined by it. Mason[4] has pointed out that the overcast humind days retard the growth of the main axis as a result of the shortage in the supply of photosynthetic material, which increases the susceptibility to shedding of bolls in cotton. Also rain interferes with the tillage operations and the inter-culture of crops that is so very necessary for aeration. Apart from the immediate damage done to crops, a change in the conditions at any time during the period of the growth-cycle of the plant affects the whole chain of growth phases later on. (Balls)[1].

In addition to the factors mentioned above, plant itself has come to be known as a living entity, with all the necessary vital process of respiration, assimilation and such others. The environment is neither simple nor compound but wholly complex. Evidently plant growth mainly depends upon the complex tripartite harmony between the plant, the soil and the environment. By modern methods of Science, it is, to

some extent, possible to manipulate the soil and the environment but without the knowledge of the working of the plant machinery, very little improvement is possible in agriculture.

The need for evolving physiologically sound types is very great in India. The modern geneticist cannot feel content merely by the production of a variety with the desired economic characters, for such varieties must also be resistive of all the possible vagaries of climate generally met with (Trought[9]). After all that was done to effect improvement in cotton by breeding, the need for work on cotton physiology was still felt and the appointment of a cotton physiologist became a necessity. The need for similar work on other crops cannot, therefore, be over-estimated.

But while there is need to evolve crop-varieties resistive of the fluctuations in climate and environment, it can be said that the Indian cultivator is quite resistent to all the adverse circumstances that befall on him through natures mysterious working. From the time the seed is sown in the soil to the time the produce is brought in his house, the fate of the farmer is always hanging in the balance. This can give us an idea of the embarrassment caused to him. But he fights all these varied odds against him, mainly by his admirable qualities of patience, perseverence and simplicity of life.

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PALM GUL AS A VILLAGE INDUSTRY

By Y. M. Parnerkar

(*Shegaon, Wardha*).

Introduction.—Destruction is the harbinger of construction. During the thrilling days of Dandi March, Mahatmaji gave a slogan of felling palm trees to check the production and consumption of Toddy. Every stroke of the axe made one think about the palm trees, the vast amount of energy the plant contains and the prostitution which man was committing upon nature by its misuse.

It was not long before that it was discovered that the fresh juice was a very rich food and could be used as a raw material for the manufacture of gul.

To-day palm gul industry occupies an important place among the industries sponsored by the All India Village Industries Association. The palm group of trees include the date, cocoanut, palmyra and sago. All of them have proved to be a rich source of nutrition. Their fermented, intoxicating juice called Toddy has got to give place to Nira, the sweet unfermented delicious beverage. Besides this, Nira on boiling yields gul of exquisite taste. The palm gul industry seems to have received a fresh and healthy impetus when the nation is in a mood to exhibit its genius to rebuild. It is making a slow and steady progress in provinces like C. P. and Bombay, and is already expanding in Madras and Bengal.

Under these circumstances, when this palm gul industry in springing into a self-supporting industry, it might interest the student of agriculture to acquaint himself with a brief study of the scope and future of an agricultural side industry promising to come into vogue.

The student needs to be introduced to this new and uncultivated field for research and development.

History.—That the very word sugar comes from the Sanskrit word Sharkara is suggestive of its origin in India. The early records indicate that sugar from palm juice was exported in considerable quantity from India. In very old times, China and Egypt had sent their representatives to Bihar to study the craft of sugar making. The industry then travelled to European countries. 'Chini' and 'Misri' are the varieties of sugar as improved upon by those countries.

After the introduction of cane, palm gul industry, of course, dwindled into insignificance in some quarters. However, even up to the present

date, it has survived in Madras and Bengal as a subsidiary occupation of the farmer.

We find that in 1787 Jessore alone had to its credit an outturn of 20,000 maunds of palm gul, half of which was exported to Calcutta. 10,000 tons that is one fifth of the total export of sugar to England from India in 1849 consisted of date sugar. In the foregoing year Madras had produced 40,000 tons of cane jaggery along with 25,000 tons of palm jaggery. Till the end of the third quarter of the last century, Madras and Bengal continued to be progressive countries in the manufacture of this article. But since then they have suffered serious setbacks by the dumping of cheap foreign sugars. To-day it is not even possible to ascertain the extent of this industry for the government has ceased from publishing figures regarding this industry.

Habitat.—Palms grow wild and wide throughout the tropics. In India we find them as cocoanut, sago, date or palmyra. Madras and Bengal alone seem to have specialised in gul manufacturing out of their juices. They grow on hills and dales, on sea coast and in plains, in arid as well as humid regions. They are almost omnipresent in some form or other throughout the length and breadth of India. It has therefore an extensive field for development. Preliminary trials in palm gul manufacture as carried out in Bihar, C. P., Bombay and Orissa hold out a promise of turning into a successful village industry.

Scope in C. P.—Date palms abound in almost all districts of C. P. Palmyra grows in Chanda and Akola while sago is also found in one of them. The tappers though of migratary habits are met with in sufficient numbers in every district. With the coming of prohibition, some suitable use of this unworked wealth has to be found out. Gul is and should be a necessary item in the dietary of the peasant. Every village therefore, can offer a ready market for this article if economically produced. Trade returns show that ours is a gul importing province and there is no reason why, with so nice a natural resource, we should not be at least self-supporting if not exporting.

Processing.—The sweet sap exuded from the trunk of the date palm and the spathes of the rest of the palms (cocoanut, sago, palmyra) forms the raw product for the manufacture of gul. The method of procuring sap from them is popularly known as tapping. Generally they are ready for tapping after the tenth year. The date tree is tapped every alternate year in all provinces except Bengal where due to their special method of tapping, they could be tapped every year without injuring the trees.

Season.—Date and cocoanut are tapped throughout the year, but their juice is only useful for gul in winter. Date juice is profuse in winter, contains greater percent of sucrose and is less liable to formentation. So winter is the most suitable season for C. P. The trees are tapped late in the evening. Earthen pots smeared with lime inside are hung below the cuts in such a way that the juice collects in them throughout the night. Early in the morning the tapper goes round and collects the juice. It is quite necessary that the whole process should be completed before sunrise. Otherwise fermentation would set in and quality of gul would be affected. The juice is then strained through a piece of khaddar and allowed to stand for about an hour, so that lime may settle down. The clear liquid is decanted and is boiled in an open pan mounted on a furnace specially designed for the purpose. While boiling the natural scum that rises on the top is skimmed off, there being no need of any defecants as in cane gul boiling. While the juice condenses to a striking stage, the pan is taken down and the viscous mass is cast into moulds. On cooling it is taken out of the moulds and is ready for market.

The fuel used is the dry leaves and stalks of the palms etc. Palm gul can only be produced from fresh juice-(Nira) and not from Toddy—the fermented juice, and hence there is no room for any intoxication in using it.

Economics.—At this stage it is rather difficult to put down exact facts and figures as, at least in C. P. this is in an experimental stage as yet. However, from what little experience, has been gained of its trials during the last two seasons at Shegaon, it could be seen that there are great possibilities of its introduction into the villages of C. P. as a side industry.

Generally speaking, one tapper with an assistant can handle 60 trees per season of 6 months in batches of 30 trees at a time. The season may be divided into two parts of 3 months each, so we need to have 120 trees for every tappers family in the village as the trees are tapped only in alternate years.

Initial Expenditure

Boiling Pan, tools etc.	... Rs.	30/-
Furnace	... „	5/-
	Total...	35/-

Annual expenses for each batch of 60 juice bearing trees :

A tapper for 6 months @ Rs. 10/- p.m.	...	Rs.	60/-
An assistant for 6 months @ Rs. 6/- p.m.	...	"	36/-
Wear and tear	...	"	5/-
Sundries (ropes etc.)	...	"	5/-
Rent of trees	...	"	15/-
Management and risk.	...	"	19/-
	Total...		140/-

Estimated Income.—The season is of six months (180 days). 75 tappings per tree are done per season deducting days for preparation and weather inclemency.

A normal tree yields 5 lbs. of juice per day. Hence we get 22,500 lbs. of juice from 60 trees in a season; or 2250 lbs. of gul (ratio of gul to juice being 1:10).

The above outturn of gul costs Rs. 140/- in production, i. e., 16 lbs in a rupee. This price can well compare with that of cane gul in the market.

Village self-sufficiency.—The call of the day is to enable a village to be a self-sufficient unit in as many commodities as possible. Let us see what could be done in our village say Shegaon. The population is 600 souls. On an average this class of people consumes about 10 lbs per capita per annum, that comes to 6000 lbs. of gul per year. We have already seen that we get 37½ lbs. of gul per tree for two years, so the village gul supply could be met with from only 320 adult trees, while Shegaon has got a greater number than this. So if Shegaon wills, it can, not only, be self-sufficient in point of gul production, but it can afford to sell it in outside markets. This industry will maintain 3 families getting Rs. 96/- per family per season of 6 months—a fairly good income as against the daily wages of three annas for a man and 1½ annas for a woman. If the gul is produced and sold locally, the management charges may be minimised.

Lines of research.—The industry is at present in the hands of ignorant, poor and illiterate persons, hence the mode and method of gul manufacture may be quite naturally very crude. If some skilled and intelligent persons, apply themselves to it, they may advance the industry a good deal and raise it to higher level. A few lines of research may be suggested as under :—

1. Preserving quality of gul should be studied and improved upon so that its hygroscopicity owing to large contents of minerals, may be averted.

2. A cheap and easily available substance to replace lime as a controller of fermentation, so that much juice may not be wasted in sedimentation.

3. Problems relating to the fuel supply and fuel economy by improving the furnace suited to palm gul process.

4. Improved method of tapping such as the one in Bengal.

5. Cultivating palms on field scale so that palms may be more productive and consequently the gul may be cheaper and abundant.

Extracts

THE SOYA BEAN

Some day in the future the Soya Bean may find a place in the paddocks of Australian farmer. In Europe, Asia and the United States, this bean is yielding substitutes for milk, cream, and cheese, as well as oils for enamels, lubricants and foundry work. This same bean is among the richest of the known vegetables and forms the staple diet for tens of millions of people in the Eastern Asiatic countries.

For centuries the Soya Bean has occupied an important position as a food crop in China and Japan. These and the adjacent countries are the chief centres of production. The value of the plant is now securing wider recognition, and its cultivation is extending to Southern Europe and the United States of America. It has been stated that the main value of Manchuria to Japan is primarily as a source of cheap and ready food supply; incidentally, most of Manchuria's cultivated land is devoted to the production of Soya Beans.

Since 1907 these beans have been growing in importance as a commodity for export all over the world. Great Britain for example, imported 160,000 tons in 1935, while Germany's importations for 1934 amounted to no less than one million tons.

The Soya Bean is an erect-growing, annual, leguminous plant, the leaves resembling those of ordinary beans or cow-peas. There are numerous varieties, varying considerably in height, character of foliage

and the colour of seed, which may be yellow, green, brown, black or a combination of these colours.

The fodder value of the plant, in a well grown sample equals that of lucerne. The tall growing varieties, Biloxi and Otootan, have given the best results for hay and fodder purposes, the former possessing a strong, erect growth, carrying dense foliage and reaching to a height of over 5 feet on the richer soils in Queensland.

While the Soya Bean is suited to a fairly wide range of soils, it prefers the loamy type, such as are best suited for maize, and although benefiting from ample supply of soil moisture, it will stand dry conditions much better than maize. The land should be ploughed to a depth of 8 inches in the winter and allowed to lie in a rough state until spring, when a second ploughing is given. Thorough cultivation and harrowing is then advisable to form a good seed-bed prior to sowing.

The dwarf growing varieties may be sown in drills 2 ft 6 in. apart, increasing the distance to 4 feet apart for tall kinds like Biloxi. A 3 ft. 6 in. spacing with the plants 8—10 inches apart, will require about 16 lbs. of seed per acre. The usual inter-row cultivation is necessary to check weed growth and maintain a surface mulch.

Harvesting is usually effected with a mower or side-delivery harvester. For hay purposes the crop is cut before the seed is mature, and handled in the same manner as cow-pea hay to preserve the leaf. Where seed is the main consideration, cutting is delayed until the beans approach maturity, but it takes place before any shelling out occurs. When carting to the thresher, waggons are lined with bag sheets or tarpaulins to minimise loss.

Soil inoculation is an interesting point in connection with the Soya Bean. It has long been known that certain bacteria must be present in the soil to enable legumes to make use of atmospheric nitrogen. Where the bacteria are absent or are insufficient, growth is improved by treating the seed with a culture of nitrogen-fixing bacteria prior to sowing. Some important increases in yield and nitrogen content have resulted from this treatment, notably in U. S. A., where Soya Beans promise to become an important crop. In the chief producing districts in which the beans are taking the place of oats in the cropping system, the rotation is maize, Soya Beans, wheat and clover.

The beans are largely used for the extraction of oil, the residual oil cake being fed to stock. Soya Bean oil can be used for a number of

purposes for which linseed, cotton-seed, and cocoanut oils are now utilised.

Use as human food.—It is as a valuable addition to our everyday diet that Soya Beans are likely to be mostly utilised. The article on "the Soya Bean and the New Soya Flour by A. M. Ware" clearly show the remarkably high nutritive value of this plant. *(Paper prepared for the Upper North Conference Australia by C. F. Ferrees.)*

THE SOYA BEAN AND THE NEW SOYA FLOUR

Soya flour containing approximately 40 per cent, protein, 20 per cent, fat, valuable phosphates and potassium, together with the important vitamins A, B, and D, is the best obtainable vegetable substitute for meat. In the chief producing countries, Manchuria, China, and Japan, it is an esteemed article of diet, forming the basis of various food preparations. In Japan a Soya Milk is made, the analysis of which compares favourably with cow's milk. Soya sauces are also in general use.

Owing to the high fat content, some difficulty was experienced in making a flour that would keep sufficiently long. This difficulty has been overcome by the "Berizellers" process, which produces a satisfactory flour that will keep.

Comparsion of Soya, Wheat and Oats

Food	Water	Protein	Fat	Carbo-hydrate	Fibre	Ash
Wheaten Flour ...	13.37	10.21	0.84	74.71	0.29	0.48
Oat-meal ...	9.65	13.44	5.92	67.01	1.86	2.12
Soya Flour ...	8.33	42.84	20.00	19.35	4.79	4.69

Illustrating Calories Per lb.

Food	Protein	Fat	Carbo-hydrate	Water	Calories per lb
Soya Flour ...	42.0	20.0	24.0	9.0	2.165
Wheat ...	12.2	1.7	73.7	10.6	1750
Beef steak ...	18.6	18 5	...	61.9	1130
Eggs ...	14.8	10.5	...	73.7	720
Potatoes ...	1.3	0.1	14.2	84.7	295

This flour contains four times as much protein and fifteen times as much fat as wheaten flour. This opens up great possibilities for its mixture with wheaten flour for bread-making in order to produce a more nutritive loaf. Owing to the abundant production of wheat, oats, maize, and barley in Australia, the establishment of the Soya Bean for flour-making purposes is likely to be slow.

However, in view of the plant's high nutritive value as a foodstuff, as fodder for stock, and as a soil renovator in crop rotations, no excuse is needed for drawing the attention of our farming community to its potential possibilities.

The present market for Soya Beans in Australia is limited, and is supplied by importations from Manchuria and Japan. Therefore, it is not suggested that farmers should engage in large scale production until the demand increases, but rather that small areas should be grown chiefly for home use. In this way growers will become familiar with the plant and will be ready to take advantage of any improved marketing conditions (*Paper prepared for the Upper North Conference Australia by A. M. Ware.*)

RICE IN INDIA

By Prof. V. Subrahmanyam, D. Sc.

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Need for change in outlook.—Rice is the most important grain crop of the world and is extensively grown in all tropical and sub-tropical countries where sufficient supply of water is available. The annual world production of rice is of the order of five hundred billion pounds, which is nearly double that of the next grain crop, wheat. Over 600,000 varieties are being grown and dozens of new ones are being added every year. The acreage under rice is very vast, being over eighty million in India alone.

The general make up of the rice grain is well known and consists of the outer coat (the husk), the neighbouring bran layer and the main body of the grain (the endosperm) with the germ at one end. Each of these parts has its characteristic composition. The husk is non-edible, being mostly made up of resistant organic matter and sand (silica). The bran is edible and is rich in proteins, fat, minerals and vitamins, all of which are essential to make a well-balanced diet. It is not, however, used for human consumption and is mostly used to feed cattle. The germ is also rich in valuable food constituents, but is mostly lost during the process of milling. Only the inner portion, which is rich in starch but

deficient in other respects, is eaten by the majority of the population. The significance of this will be discussed later.

General Classification.—For general purposes, the different varieties of rice may be classed under three main heads:—hard, soft and glutinous. The hard varieties are the most popular and fetch the highest prices. Their kernels are strong, compact and glassy. They stand milling and can be easily transported without much damage. The soft varieties are generally white and brittle. They generally crack on drying and break on milling. The glutinous varieties are comparatively rare in India, though very popular in China and other Eastern Countries. They are chalky in appearance, mill poorly and cook to a pasty condition. Other recognised classifications are fine, medium and coarse, depending largely on the size and appearance of the kernel. There are also the broad divisions of coloured and white rice as well as scented and non-scented. The colour may range from perfect white to almost black. It is of course only 'skin-deep' and confined to the bran layers, the inner kernel being white in all the cases. The scent is a varietal characteristic. It reminds one of the mild mahua flavour.

The hard varieties (white or coloured) are best suited to cooking in water. The soft varieties cook to a pasty condition but improve considerably after parboiling. The glutinous varieties are unsuitable for cooking (as ordinarily practised in Indian households), but make good pastries. The scented varieties are very popular for certain special preparations like *Pulav.* Hard and coarse varieties with thick bran layers do well in baking, preferably after admixture with other flours. The same varieties can also be used for preparing alcoholic beverages after polishing.

Qualities that appeal to consumers.—The qualities that appeal to different sections of consumers may be placed under the following main heads.—(1) colour, (2) shape and size, (3) flavour, (4) polish, (5) manner and extent of curing, (6) behaviour on cooking, (7) digestibility, and (8) general sustaining power. The tastes are highly variable, but it may be stated that white varieties are generally preferred to the coloured ones. (In certain parts of the west coast of India coloured rice is preferred to white, but this may be regarded as an exception). Small and shapely grains are preferred to big and coarse ones. The scented varieties are popular in North India, whereas in South India, non-scented ones are preferred. All consumers prefer rice which has been stored for some length of time. Certain sections like raw rice (without any treatment), while others prefer it parboiled. Parboiled rice is generally popular on

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the west coast of India while on the east coast, it is consumed chiefly by the working classes. The richer and the middle class people like rice varieties, which are easily digested while the poorer folk prefer varieties which digest slowly and will consequently be more sustaining. It has been reported that, shortly after the introduction of new and high yielding varieties in certain parts of South India, the working classes complained that such varieties did not suit them. They reported that whereas they were content with only two meals of the older varieties, even three meals of the new ones did not satisfy them.

In addition to the above, the consumers are keenly interested in the nutritive value of different varieties, but have as yet very little scientific information thereon. They are largely guided by popular impressions based on general experience. Some of these have been borne out by recent scientific work, while others seem to be unfounded.

Chemical composition.—The chemical composition of rice has been determined by a number of workers. The recent work of Dr. A. Sreenivasn and Mr. V. Sadasivan of this department would show that the composition is more variable than was originally supposed. Thus, proteins vary from 7.0 to 10.0 per cent: phosphoric acid from 0.6 to 1.2 per cent and lime from 0.06 to 0.11 percent. It has been found that the coloured and the so-called coarse varieties are generally richer in the essential nutritive elements than the white and 'fine' varieties which fetch the highest prices on the market. These observations have been supported by the independent histological findings of the Coimbatore workers.

The reason for this apparent anomaly is not far to seek. The public taste has so far been largely in favour of the white and high-yielding varieties and the plant breeder has done his best to cater to it. Nutritive value has yet no place in his scheme. The result is that he has gone on selecting or breeding varieties which are predominantly starchy but poor in other essential constituents. If, on the other hand, the public awaken to the realisation of the situation and demand nutritively rich varieties, the position will soon be reversed. The so-called coarse and inferior varieties will take their right place on top of the table. Further search will no doubt reveal the existence of varieties which are even richer than those so far reported, and which perhaps may surpass wheat in regard to essential nutritive constituents.

In spite of its great popularity, rice is to-day classed as an inferior grain, poor in necessary food factors. The stigma is rather unfair because

human fashion sought certain external characteristics and selected only the poorer varieties. Once the present outlook is changed, there will be no difficulty in producing nutritively superior varieties of rice.

Rice protein highly nutritious.—There is ample experimental evidence to show that rice protein, small as it is in quantity is nutritively superior to that of wheat. It is richer in regard to the essential amino acids and taken on equal weight basis, promotes better growth than wheat protein. Unfortunately, the present taste is such that even the small quantity of protein is largely rejected in the form of bran and only the residue is eaten.

Some varieties of rice are fairly rich in phosphorus which is necessary for the building of the bone. Others are comparatively poor. A large part of the phosphorus is present as phytin, which is not readily available for human nutrition. Cooking and digestive juices increase the availability but further improved methods are needed.

The commoner varieties of rice are very deficient in lime. The proportion of phosphatic acid to lime is of the order of 10 to 1, whereas it ought to be somewhere about 1 to 1. There is evidence to show, however, that some of the hitherto neglected varieties are comparatively rich in lime. Further search in this direction will yield valuable results.

The majority of rice-eaters are predominantly vegetarian by tradition, habit or necessity. Many of the vegetables are rich in lime and may thus partly make up the deficiency in rice. A large section of consumers—at any rate in India—also chew—*pan* which includes some lime and thus supplements the deficiency in food.

Some of the coarse varieties of rice are fairly rich in iron, which is quite necessary for making a well balanced diet. Many of the vegetables are also rich in that constituent, so that, ordinarily, there is not much shortage in that direction.

Manuring.—Certain sections of scientific workers incline to the view that the nutritive constituents of a grain cannot be appreciably increased by manuring. That may probably apply to other grains, but it is not quite true in the case of rice. Rice can be enriched, at any rate, in regard to proteins, by judicious fertilising. Both organic and mineral fertilisers evoke the necessary response, the effect being more striking in the case of the latter. The best time for application—at any rate in the case of certain varieties—seems to be about two months after planting. Increase in protein content to the extent of about 20 per cent has been reported.

In actual practice, enrichment of the grain by suitable fertiliser treatment may not prove paying. Very few farmers can afford the extra quantinty of fertiliser needed for the purpose. Moreover, the consumer cannot distinguish between nutritively rich and poor grains and will pay the same minimum price for both. The only direction in which some useful result can be obtained seems to be that of selecting and breeding nutritively rich varieties. This work requires the co-operation of the plant breeder and the chemist and there is no doubt that, if the consumer demands it, a number of varieties possessing the required qualities can be evolved and the seeds supplied to farmers.

Period of crop and quality.—There seems to be a general impression that rices grown, during certain seasons of the year are nutritively superior to those raised in others. There is also the common belief that long duration crops are more nutritious than short duration ones. Some scientific work has already been done with the object of verifying these, but more extensive enquiry is needed before any definite conclusion can be drawn. Judging from chemical composition, some of the short duration crops are even richer than the commoner long duration ones. Duration is not, however, a safe criterion because what is long duration in one part of the world may not be so in another part. Thus, some of the long duration crops of Japan turn out to be short duration crops in India and *vice versa*. Any way, there must be some basis for the popular belief and more extensive scientific enquiry is needed.

Dry and wet cultivation.—Rice is generally wet cultivated but there are certain dry cultivated varieties which are grown on the west coast, in some of the agency tracts, on the east coast, in Chota Nagpur and elsewhere. These do not require puddling and prolonged swamping in some way as the commoner varieties do, but are still not so "dry" as commonly believed. They are often raised on hill slopes and get useful supplies of water through seepage in the substrata. As compared with the other varieties they are poor yielders and the grains are generally coarse and coloured.

Dry cultivated rices are popularly believed to be more nutritious than wet cultivated ones. Working with experimental animals, Sir R. McCarrison also came to a similar conclusion, but more recent experimental work does not entirely support this view. When the same variety is raised under dry as well as wet cultivated conditions, the grains from the latter are invariably richer in proteins and minerals than those from the former. This is supported by the work of the Paddy Specialist and his

associates at Coimbatore who find that the wet cultivated rice has a thicker bran layer than the same variety grown by dry cultivation.

The above observations are largely of academic interest. Dry cultivation is more a matter of necessity than of choice and the farmers will gladly forsake it as soon as a liberal supply of water is available.

As already mentioned, the varieties that are grown under conditions of dry cultivation are the coarse ones which are generally rich in nutritive constituents. If the same varieties are grown under conditions of wet cultivation, they will not only yield better, but they will also bear richer grains. It may be hoped, therefore that, with the necessary change of outook, the white and starchy varieties, which are the fashion at the moment, will be replaced by nutritively richer varieties which are now being largely neglected.

MUTUAL GIFTS OF CATTLE BETWEEN AFGANISTAN AND INDIA

A unique mutual presentation of breeding-cattle has taken place between His Excellency the Viceroy and His Royal Highness the Prime Minister of Afghanistan. This friendly gesture in a matter close to Lord Linlithgow's heart was initiated by the Afghan Prime Minister, who when acquainted by Sir Arthur Olver of the Viceroy's wish to purchase some Afghan hill cattle for breeding purposes in India, insisted on presenting a bull and a cow with a calf to His Excellency, and also two bulls for the Imperial-Veterinary Research Institute at Muktesar.

Lord Linlithgow has reciprocated this courteous gesture by purchasing for presentation to His Royal Highness a splendid specimen of a Sahiwal bull from the Imperial Agricultural Research Institute, New Delhi. His Excellency personally inspected his gifts from Afghanistan following their arrival by motor truck.

Sir Arthur Olver himself brought these animals in a trailer attached to his car as far as Peshawar. There they were handed over to the local Veterinary hospital, where they were kept for three weeks to be immunised against rinderpest. The two bulls for the Muktesar Institute were then railed to Bareilly for despatch to the Institute, and the cattle intended for the Viceroy to Taradevi.

Size of Afghan Cattle.—These Afghan hill cattle are small compared with animals from the plains. They measure only 35 to 40 inches from behind the hump to the ground, while cattle belonging to the plains

average between 50 to 60 inches. They are dark red and black in colour, with occasional white markings. Those presented to the Viceroy have small well bred heads and are dark red and white in colour. They are of the type of animals to be found in the Simla Hills and the Kumaon District (in the United Provinces), but the milk capacity of the Afghan cow is about 16 lb. as compared with the 6 or 7 lb. of the Indian cow.

The cow is about three years old, with a two months old calf. The bull is 18 months old. At present it is planned to keep the Viceroy's cattle at Keventer's dairy farm at Taradevi. A daily record of the cow's yield of milk will be kept. The bull will in a year's time be used for breeding purposes with local hill cows.

The two bulls at Muktesar will serve for the improvement of the cows in the Kumaon District. The progeny of the local cows bred out of these bulls is expected to yield more milk than their parent cows.

Recent Afghan Progress.—His Excellency the Viceroy's keen interest in cattle-breeding is shared by His Royal Highness Sardar Mohammed Hashim Khan, the Prime Minister of Afghanistan. His Royal Highness owns a large farm in the neighbourhood of Kabul and vast tracts of land in the interior. As a cattle-breeder he has been very successful, and his farm is regarded as a model throughout Afghanistan. He is also a breeder of horses and an experimenter in horticulture and fruit culture. The recent developments in agriculture and farming in Afghanistan are due, to a large extent, to his enthusiasm.

Some time ago the Afghan Government asked the Government of India to send to them an expert in Animal Husbandry and Fruit Culture to help them to develop these industries in Afghanistan. Sir Arthur Olver, Animal Husbandry Expert to the Government of India, was accordingly sent to Afghanistan in the middle of April last and stayed there for over a month. While in Afghanistan Sir Arthur Olver delivered a series of lectures and made an extensive tour of the country. On his return to India he compiled a report containing his recommendations for the development of Animal Husbandry in Afghanistan, which has been sent to the Afghan Government through the Political Department. *(Abstract from the Times of India, June 21, 1938).*

THE DUTIES OF VEGETABLES

By Mrs C. Schulz Morchard.

Every vegetable has its own particular duty to the individual from a medicinal point of view, and vegetables should therefore be taken freely and in variety.

Onions are excellent both as food and medicine. They will help the digestion and purify the blood. Eaten boiled at night, they will cure a cold and induce sleep, so that nervous and restless people should include them in their diet.

Celery is splendid for those people who suffer from rheumatism. When boiled, the water should be put in soups and stews. A little raw celery eaten after heavy meals helps digestion.

Water cress should be eaten in spring. It is a tonic and blood purifier, but it should be well masticated.

Spinach, asparagus, paısely and beans have a good effect on the kidneys and help in the curing of all kidney troubles.

Tomatoes are good for the blood and all affections of the liver.

Potatoes are a staple food. They are very nourishing. Especially for thin people. Stout people, however, should eat sparingly of them and make up their loss with other non-fatterning vegetables.

Lettuce, spring onions and cucumber are good for cooling the blood. Those who cannot take them raw should have them boiled like spinach.

Carrots, turnips are useful foods. Carrots clear the skin from blemishes.

Cabbage, curly greens and sprouts should always be taken freely. The juices of them are necessary for the blood, and their use cures and prevents scurvy and other skin diseases.

Beetroot nourishes the blood and should be eaten by the anaemic.

Persnips boild are very good for lumbago and similar complaints.

The juice of tomatoes is a perfect softener and whitener for the skin. It is especially valuable after sun bathing if it is rubbed daily into the shoulders, arms and hands,—(*Queensland Agri. Jour,*)

CARROTS AND THEIR USES

By S. Schwaiz, Maltee

(Ceduna Conference)

Carrots have a great advantage over many other vegetables, as they can be obtained all the year round, they are easy to grow and can be used by every member of the family, from the tiny baby to the grand parents. In California the value of the carrot crop last year was £ 1,000,000, and 15,700 acres of this vegetable were grown.

When preparing them, wash well, but do not scrape; a soft nail brush is best kept for this.

To extract the juice from carrots, grate and then squeeze through a meat mincer with a basin underneath to catch the juice A tea-spoonful of juice per day may be given to children from a couple of months old. Those who have this daily have a stronger digestion and better all round health. It is one of the best preventives of common ailments.

In Los Angeles and Hollywood carrot and celery juices are delivered in bottles in the same way as milk, and business men are drinking these health-sustaining juices in place of their usual morning and afternoon tea and coffee. It will not be long before these juices are sold here as freely as milk in our city shops, for Australians are as keenly food and health conscious as their cousins over the sea.

Grated carrot taken every morning before breakfast is a good complexion beautifier. It also improves the hair, giving it quite a glossy appearance. A healthy salad may be made with grated carrot to which is added a little salt cream and lemon juice.

To bake carrots.—Wash about 12 medium-sized carrots, but do not scrape or cut. Dry thoroughly and put on shelf in oven or put into a paper bag. Bake until soft-about ¾ to 1 hour. When done, the outside skin is shrivelled and dark, but the inside is soft and juicy. Carrots, beets, onions, parsnips, as well as potatoes, are delicious baked this way, although beets are best baked in a dish with a lid to hold the juice. No dishes are needed and no fat or water; it is both economical and healthful.

Carrots also add to the nourishment and flavour of soups and stews, and grated carrot in steamed puddings as well as jam, is also very nice. When eggs are a scarcity carrot is a very good substitute; one small grated carrot equals two eggs.

Grated carrot and a little onion (if liked) make good sandwiches for school children. For a poultice, use freshly cooked carrots without salt; mash, and while still warm place on the wound. Change every six to eight hours.

Although often looked down upon, the carrot contains a large amount of mineral elements which counter act body acids and poisons. Carrot also possesses certain antiseptic properties which remove impurities from the system.

To grow this vegetable, a fairly rich soil is needed. A plot where tomatoes or cabadges have been grown suits them well; no fresh manure should be added. If sown in July or August they do not go to seed, and you have carrots all the year round.

SUGGESTIONS FOR ARRANGING AND PROLONGING LIVES OF CUT FLOWERS

By Mrs. Ware, Wepowie.

No home has achieved its best until flowers have their rightful place in it. Flowers can add the final lovely accent to the colour scheme. Some people have an instinctive flair for producing interesting and charming floral arrangements. However, given a natural love for flowers, any one can soon learn how to obtain satisfying results if a few simple rules are learned; speed comes with practice.

True lovers of flowers are for ever experimenting with colour and trying new ways of grouping, and more often than not the results are enchanting. For instance, a large meat dish can be used for skilfully arranging short-stemmed simple garden blooms. Some examples of flowers which look well arranged thus are Petunias, Phlox, Begonias. Forget-me-nots, Autumn Leaves with Fuchsias, Violets on their leaves or Nasturtiums with their bright circular leaves. A judicious combination of flowers makes for interest and avoids monotony, but, in all cases, a single kind of flower should predominate.

The scope of arrangement is endless, the effect always charming, if taste is used in choosing suitable flowers for each arrangement. For instance, pieces of shrubs with green leaves and coloured berries or pods placed in wet sand in an oblong box make a bright suggestion for a day time screen for the fireplace, whereas Dahlias would be out of place, Then, again, imagine deep, rich-red Cactus Dahlias as a central decoration on a formal dinner table their dignified beauty accentuated with shining silver and glass on a polished mahogany table, and tall, tapering red candles in flat silver holders shedding a soft light over the scene.

Marigolds, Nasturtiums, Gaillardias, and the like would be out of place here, and yet they would be happily at home on the breakfast table.

To prolong lives of flowers.—Flowers should be cut during the coolest hours of the day, when the tissue is filled with moisture—early morning or lat afternoon. They should be cut with a sharp knife. If the cut is slanting, the water-absorbing surface is increased considerably, particularly when the stems are thick and heavy. Another advantage is that a slanting cut prevents the cut surface from resting squarely on the bottom of the vase or bowl and clogging the tubes through which the water is drawn into the stem. In any case, the stem should never rest on the bottom of the receptacle.

Do not arrange flowers immediately upon gathering them; they are likely to wither quickly. Rather, after cutting plunge the stems in a deep receptacle, water filled, but do not submerge the blooms, and leave in a cool place for a few hours. Flowers which have been thus "cooled" are more easily and quickly arranged, for the stiffened stems permit the placing of each flower in the definite position it is to occupy in the floral scheme. The lower leaves should be removed, for not only do they choke up the vase and make arrangement more difficult, but they become slimy and unpleasant in a very short time. Flowers that have wilted after a journey may be freshened by plunging the stems into boiling water and leaving them until the water is cool. Then cut off the ends of the stalks and put into cold water to properly revive. It is also claimed that a small piece of charcoal in the bottom of the vase will prolong the keeping qualities of flower. Another idea is to stir a tea-spoon of saltpetre or of carbonate of soda into the water in which the flowers stand each time the water is changed. Anemones and Ranunculi last much longer if placed in a bowl of wet sand.

FENCING IN OF GRAZING LANDS BY ELECTRIC WIRING

It is known that all animals of any kind have a marked distrust of electric currents, even of very low voltage. This fact has suggested the plan of employing in place of barbed wire fences requiring numerous lengths of wire, a single isolated electric wire attached to light stakes fairly wide apart while passing through the wire a very low charge of electricity. The experiments were highly successful; after one or two contacts with the electric line, no animal took any further risk of remaining in its immediate vicinity.

On the basis of these experiments in many countries, special transformers are now employed of a particularly safe type, by means of which the farmers for purposes of fencing in grazing lands may convert the current of the line into a current harmless for man and animals although at the same time sufficiently effective. If the farm is not served from a power station, the necessary current may be obtained by means of a small electric battery. This system of fencing in with electric wiring which is by far the simplest, has become highly popular in the United States and is now arousing considerable interest in England and Germany. In the United States of America practical experiments on fencing grass lands have resulted in utilizing fairly high voltages with minimum amperages. In this case the wiring round the stake should be well isolated. Even with continuous use a minimum current costing usually only a few centimes a month is employed.—(*Extract from the "International Review of Agriculture" January 1938*).

BUTTERFLY FARMING IN ENGLAND

Apropos of recent discussion in Scientific American of butterfly farms, the editor has received a letter from C. P. Graham, of Erith, Kent, England, which we quote in its entirety :

"It may interest your readers to know that for more than 30 years an Englishman has successfully conducted a butterfly farm at Bexley, near London. This is no mere hobby, but a full-time job. Indeed, during the busy months he employs four assistants.

"Every spring the farmer collects caterpillars of different species in the fields and hedgerows. In this respect it may be said that his 'farm' extends from the north of Scotland to be south coast of England. Thirty years of breeding and collecting have taught him just where to look for the particular species he most requires, even to the very field or hedge. In this country certain species are confined to small, well-defined localities.

"The caterpillars are brought home and classified. Some are placed in special feeding chambers made of finely perforated tin. Others are placed to feed on the leaves of trees growing on the farm. The trees are then covered with sheets of fine muslin, tied tightly round the bole, so that from a distance they resemble gigantic mushrooms.

"Among the farmer's chief customers are schools, colleges of pestology, and private collectors. Every year he supplies a large number of live specimens for exhibition at the London Zoological Gardens.

"The farmer told me quite recently that he had a great stroke of luck a few years ago. A cage containing a number of chrysalises of a particular species was accidentally knocked to the floor. The male and female of the butterfly (I forget the name) are of different colours. When the butterflies emerged he was delighted to find a number of specimens which shared the colouring of both male and female. Eight butterflies graduating, half a wing at a time from the perfect male to the perfect female, were selected for mounting, and the collection was bought by a wealthy collector for 100 pounds.

"The farmer makes a specialty of breeding almost black specimens of many kinds of butterflies. These, he told me, command a high price among private collectors." (*Extract from ' Scientific American, June 1932.*

THE UTILITY OF CANE SUGAR IN MORTAR

In a paper presented before the Sugar Division of the American Chemical Society recently, Drs. Gerald J. Cox and John Metschl, of Mellon Institute of Industrial Research, Pittsburgh, discussed their current investigations of the value of cane sugar in strengthening lime-sand mortar. Such an application of sugar is not new, as it is believed that the Romans made use of such materials in mortars that have certainy stood the test of time. Also, in sugar-growing countries, it is known that sugar has been employed to in crease the strength of mortar.

Drs. Cox and Metschl found that there is very good reason for the empirical practice of "sweetening" mortar. From their experiments they ascertained that mortar which contains sugar equal to 6 per cent of the quick-lime content has a tensile strength 60 percent greater than that of mortar containing no sugar. Further tests are planned of compression strength, setting time, and durability as influenced by cane sugar.

The process of mixing the sugar with the mortar is quite simple. The sugar is dissolved in part of the gaging water and mixed in with the sand and lime. The sugar most not be mixed with the lime before slaking.

With the present low price of sugar, the five or six pounds of sugar necessary for 100 pounds of lime is only a small addition to the cost of laying bricks or plastering a wall.—*Scientific American June 1932.*

STERILIZING MILK WITH SOUND WAVES

Milk and similar liquids may some day be sterilized by subjection to a "terrific squeak" instead of by heat treatment. This possibility is visioned as a result of experiments by Dr. Leslie A. Chambers and Prof. Newton Gaines of Texas Christian University, at Fort Worth, Texas. The apparatus which they have constructed and used in their laboratories averaged a kill of 80 percent of all bacterial present in various samples of milk, and in a few samples it produced complete sterilization.

The new apparatus was evolved from an earlier form used by Professor O. B. Williams of the University of Texas last year. Basically it involves the same device: A nickel tube caused to vibrate intensely and at a high rate by being placed in a rapidly alternating magnetic field controlled by mechanism similar to that used in radio broadcasting. This causes the tube to "sing" with an exceedingly high-pitched audible note. Partially immersed in water or other liquid, its intense sound waves are very destructive to bacteria and other small organisms.

In the apparatus used last year, the experimenters killed bacteria in a flask. This year's endeavour was to develop a means of sterilizing or partially sterilizing liquids as they flowed past and around the tube, making the process continuous instead of intermittent. This was accomplished by inserting the upper half of the nickel tube into a larger tube of glass, making the joint by means of a water-tight rubber collar. The lower end of the tube was given the magnetic impulses, and the upper end drove its high-frequency sound waves into the milk as it flowed through the space between the two tubes, and especially as it flowed through a narrow funnel-shaped outlet.

The laboratory model was of sufficient size to allow continuous treatment of milk at the rate of 100 quarts an hour; but the nature of the apparatus is such that the capacity may be expanded almost without limit, the experimenters state.

With the co-operation of a local commercial milk concern, the apparatus was tested on a large number of samples of grade A milk, with initial bacterial counts varying from 8000 to 30,000 per cubic centimeter. A few samples of pasteurized milk showing 3000 to 5000 counts were also tested, with results indicating that the vibration treatment destroys germs not affected by pasteurization temperatures. The germ count in all cases showed an average reduction of 80 percent, and in a few samples all germs were killed.

The sound-wave treatment, however, does not destroy bacterial spores: but such spores are also immune to pasteurization. Fortunately for both methods, the real trouble-making germs in milk are not spore-formers.

Other liquids that may eventually be treated by the new method include certain dietary products, commercial alcohol, fruit juices, and delicate sera for use in medicine-in general, products that require a radical reduction in germ count, if possible, without heating.—*Science Service.*

College and Hostel News

After a lapse of complete two months of weary summer, the college re-opened on the 13th June 1938, with an opening address by the Principal, Mr. E. A. H. Churchill. He emphasised the necessity of practising the habits of punctuality and hard work by every student, as they form the key to a successful college career, nay, even one's own life: we are sure that every one of us will follow his valuable advice.

It gives us great pleasure to congratulate the following of our friends for having attained a well-deserved success in the University Examinations.

Mr. W. B Date ... 1st. Division in the B. Ag. Examination and the award of Sir Arthur Blennerhassett Memorial Medal and Chakradeo Memorial Medal.

Mr. G. R. Sirpurkar. ... 1st. Division in the Intermediate Agriculture Examination and the award of Sir Arthur Blennerhassett Memorial Medal.

Messrs. V. B. Mandlekar, V. W. Deshpande, and S. K. Gangrade for having stood in the 1st division in the Intermediate examination in Agriculture 1938.

We take this opportunity to offer our felicitations to some of the past students of our college who are earning distinctions and are bringing honour to their alma-mater. Dr. V. G Vaidya a distinguished scholar of our college who is recently awarded a Doctorate, has been appointed as an expert in the preservation of fruits by a fruit canning company in Lucknow. Mr. M. S. Killedar, and Mr. M. A. Kolkhede, two new graduates of our college have been awarded the King Edward Memorial Post-graduate scholarships for higher studies in Chemistry and Dairy Industry respectively. We are glad to find that the King Edward Memorial Committee is giving due consideration to the necessity of encouraging higher studies in Agriculture. It now remains upto the recipients of the scholarships to justify the help given to them, by doing some useful work.

The elections to the various offices in the social activities of the college were contested with great zeal. These college activities really afford a good opportunity to the students in training themselves in doing some good work. It is here that habits of selflessness, perseverence and industriousness are formed. It should be considered, therefore, by

everyone who is elected to the office, that it is a chance for him to learn something and justify his election in the best manner possible. These elections have again a great educational value to the students in general as they begin to learn the value of selecting the right man for the right type of work. These qualities if rightly developed are bound to stand them in good stead in later life. The following is the result of this year's elections.

College General Secretary	...	Mr. V. B. Mandlekar.
General Secretary for sports	...	„ B. W. Lakhe.
Football Captain	...	„ B. T. Wankhade.
Hockey „	...	„ S. N. Sakalley.
Tennis „	...	„ C. M. Kekre.
Volley Ball „	...	„ R. N. Tiwari.

THE DEBATING SOCIETY

Vice President	...	Mr. D. G. Dakshindas.
Secretary	...	„ V. P. Avadhoot.
Joint Secretary	...	„ B. W. Lakhe.
Elected Members	1.	„ M. C. Gangarade.
	2.	„ M. N. Huddar.
	3.	„ M. K. Oak.
Hostel Librarian	4.	„ D. R. Vaidya (nominated.)

We congratulate all the above students and hope that they will show to us by their work that the students have rightly chosen them as their representatives.

This year 54 students were admitted to the first year. A large number of the applicants had to meet disappointment as they could not be taken in, due to lack of sufficient equipment in the college for a larger number.

The Hockey and Football teams have as usual started practising with great zeal. This year the continuous rains have proved to be a great hindrance to such open air sports. From this year we have decided to discontinue playing cricket, as it used to take a big slice of our slender finances for sports. By this we have now been able to pay more attention to all other games. We hope that this would serve as an impetus to our Hockey and Football teams to make a better performance in the University Matches and to bring back again the past glories of the sports of our college. As Mr. B. S. Rao our games Superintendent is busy with many other official duties the Principal has appointed Messrs. N. M. Joglekar and M. A. Rahim to assist him in supervising Tennis, Football and Hockey games.

The College Debating Society has made a good start this year with a lecture by Dr. R. H. Richaria, the oil seed specialist, (C. P. & Berar). He clearly showed with the help of results obtained in his laboratory how linseed growing could be made more profitable to the growers, by utilizing the linseed fibre in making ropes, carpets etc. Indeed if linseed fibre is utilized in this manner, it would serve to yield the grower, a small subsidiary income either by selling the stuff, or by preparing the articles in his own spare time.

The annual Janmastami and Ganesh festivals are nearing. Preparations for these have been started. It is proposed that a Marathi and a Hindi Drama should be staged. We hope that both these festivals, which are a peculiar feature of our college keep up their high tradition of the past

years. It would be desirable if the Social Gathering of this College, which is being day by day less attended to, be revived with greater vigour and be made to serve as a unique occasion every year for the past and present students of the college and the staff to meet together and maintain friendly understanding between one another.

The College Hostel Library and the College Co-operative Society have as usual started working. It would be more beneficial if the Hostel Library is supplemented with a few more publications.

We close this by thanking all the office bearers of the past year, for the great exertions that they incurred in doing their respective duties with a great zeal.

Departmental Notifications

Transfers

Name of officer	From	To
Mr. G. V. Bapat	Offg. E. A. D., Drug	Offg. E. A. D., Nagpur.
,, Maniram Singh Barker	Leave	E. A. D., Hoshangabad
,, M. V. Jamkhandikar	Offg. E. A. D., Hoshangabad	Offg. E. A. D., Drug.
,, R. N. Dube	Offg. E. A. D., Drug	A. A. Western Circle.
,, N. G. Suls	Leave	Offg. E. A. D., Betul.
,, V. D. Kalvit	Offg. E. A. D., Betul	A. A. Southern Circle.
,, J. F. Dastur	Leave	Mycologist to Govt. C. P.
,, N. K. Pendse	A. A. Dharni	A. A. Ellichpur.

Leave

Mr. R. N. Kayastha	E. A. D., Nagpur	4 months 18-6-38
,, D. G. Sawangaonkar	E. A. D. on Cotton Research work	4 months from 15-7-38
,, G. M. Joshi	A. A. Ellichpur	3 months and 24 days preparatory to retirement

Retirement

Mr. A. B. Padmanabha Aiyar	E. A. D., Agri. Chemists' Section	From 1st July 1938

ERRATA

Vol. XII. No. 4 May 1938,

Page 149. Table No. 2. For festival, 3-8-0 read festival, 0-8-0.

Page 206. Paragraph 1, Line 7. For $\frac{3}{4}$ ft. read $3\frac{3}{4}$ ft.

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Editorial

ELECTRO-CULTURE

Coimbatore has been described as the Mecca of Sugar Cane Scientists. Mainpuri in the United Provinces is now becoming Mecca of persons interested in a new sphere of activity namely "Electro culture" Dr. Barber and Rao Bahadur Venkataraman are remembered through the Coimbatore canes which have revolutionised the sugar industry in India. Sir Albert Howard and late Lady Howard are remembered through the Pusa wheats some of which have became famous even in far off lands like Australia. Dr. Nerhu, I. C. S. Collector of Mainpuri and Dr. Mishra now loom large before the public, interested in the latest methods of crop improvement by their valuable demonstrations of the great improvement effected in plants by the use of electrical energy. Their researches in this new field of Electro-Farming have been published in the bulletin Nos 53, 61, 62, and 14 (Fruit series) of the United Provinces. Some provinces and Native States have deputed their officers to study the technique followed at Mainpuri. By Electro-Farming is meant the application of electricity or electro-technical methods to the culture or growth of plants. The application of electricity to the ancillary operations like working machines, heating water do not come under the category of Electro-Farming. In Electro-Farming the success is attributed to the energisation that takes place of the seed, the

soil and the plant due to electric current. Energisation due to ultra violet rays resulting from electrical activity comes under purview. Specially prepared apparatus are used for energising the seeds, soil, plants etc.

Two ways of energising plants and seeds which are referred to, by people who are acquainted with the researches at Mainpuri by the use of Agaskarised water and the onionised water are particularly interesting and likely to prove more useful than energising plants, seeds soil etc. with specially prepared apparatus the use of which cannot be easily undertaken by the cultivators.

AGASKARISED WATER

The transformation caused by the shooting of a high tension spark in the water contained in an insulated vessel and the effect of such water on plants and animals including human beings, are known as the Agaskar effect. Water thus electrified, known as sparked water, when poured over plants energises them and ensures a healthy growth. While pouring the water, the water should be taken out from the insulated vessel with wooden ladles and poured over the plant so that the water may trickle down over as large a surface of the plant as possible. Two or three cup-fulls are said to be sufficient for each plant. Over-dosing is said to result in the plants getting burnt. The dose depends on the size of the plant. Sparked water is said to have rejuvinated even diseased orange trees in a village near Chittoor in the Madras Presidency. Sugar cane sets soaked in sparked water are reported to have germinated vigourously and given rise to thick canes. By using sparked water for irrigation it is stated that the keeping quality of Juar has been very much improved. By Agaskarising the sugar-cane juice, while yet in the pan with a magneto for a few secunds it seems that the juice has been excellently clarified and no need for clarifying agents like activated charcoal etc. was felt. On alkali lands where no crop would grow, excell-ent crops of sugar-cane, are reported to have been harvested even

without addition of manures. It is the electrified water that seems to have produced this magical effect.

According to Dr. Nehru, I. C. S. the following factors seem to be beneficial to the fertility of plants and animals (1) Radiant energy (2) Primary energy (3) Absorbed energy (4) Secondary energies (5) Energies of higher denominations. Practical methods have to be found out by the electroculturist by means of which the radiant energy content in-flow and out-flow can be increased with benefit to the whole life cycle of the specimen.An optimum state of equilibrium between the cosmic energy from the soil and the belt of electric wave surrounding the Agaskarised substance makes the latent energy in plants or seeds to manifest itself in luxuriant foliage, flower, or fruit.

Trees are found luxuriantly growing in places where conditions for growth are least satisfactory for instance on forts, between walls, etc. This is a baffle to the soil physicist. The electroculturist attributes the growth to radio magnetic energy by means of which the roots are able to absorb food materials from even otherwise inhospitable environments.

ONIONISED WATER

Root crops and particularly onions emanate ultra violet ray or M-ray or Gurwitch ray. This emanation corresponds to the electric energy found round the human body in the form of an aura. Dr. Nehru calls this energy the " light from the blood." The ultra violet ray emanting from onion is made available for energising plants and for treating certain diseases among human beings by transferring the energy into water. Small sized onions half to one inch diameter are found to give out more emanations than big sized ones. The emanations continue for 24 hours after the onions are lifted out of the soil. The onions with the roots intact should be pulled out carefully from the soil. The adhering earth should be carefully washed away. These onions should then be kept in an earthen or wooden

vessel surrounded by 200 times their volume of water. The ultra violet ray gradually gets transferred to the water. This water is what is known as onion water. While the onion plant is still growing, water which comes into contact with the onion also gets "onionised." Hence planting of onions along a main channel will result in supplying to the irrigated crop "onionised" water which according to Mainpuri experiments has proved an excellent substitute for agaskarised water or sparked water in energising plants. In some cases, for instance in an experiment concerning germination of wheat, onion water treated wheat germinated even better than "agaskarised water" treated wheat. On garden crops like cabbages the effect of onionised water seems to have been marvellous. For supplying an acre of land with onionised water it is suggested that two beds of onions each 10 ft. x 10 ft. should be planted and water should be allowed to pass through these beds on alternate days so that time may be given for each bed for the revival of the necessary energy.

Onionised water seems to have been effective in the treatment of deseases like rental colic, intestinal colic, constipation, conjunctivits, sore throat, enlarged thyroid, bubonic plague, ulcers, burns etc.

Original Articles

THE GOVERNMENT DEMONSTRATION PLOT, AMARMAU, TAHSIL BANDA, DISTRICT SAUGOR, C. P.

By Dr. R. J. Kalamkar, B. Ag., Ph. D.
(Dy. Director of Agriculture, Jubbulpore)
AND
A. L. Shrivastava, L. Ag.
(Agricultural Assistant, Saugor.)

Soil and Crops.—As is well known, Banda is the poorest tahsil in the Saugor District, containing a large area of hill and rock with some open plains of limited extent in the south. The soil of the tahsil is of a comparatively light description, capable of raising inferior autumn millets and oil seeds under ordinary farm management. The crops are much exposed to the depredation of wild animals in certain portions of the tahsil.

Statistics of total cultivated area and percentage distribution of certain important crops of the tahsil are given below with figures for other tahsils, for the year 1936-37, for comparison.

Tahsil	Total cultivated area	Percentage and distribution of						
		Paddy	Juar	Kodon Kutki	Kharif Til	Niger	Wheat	Gram
Banda	193,675	2.5	6.3	7.0	1.6	4.8	30.2	5.5
Saugor	370,349	1.4	1.8	0.5	0.6	2.7	47.4	7.7
Khurai	232,050	1.8	5.9	2.0	—	4.1	42.7	11.0
Rehli	281,876	4.3	1.8	3.5	2.1	—	32.7	6.6

It will be observed that in the Banda tahsil the proportion of *Kodon* and *kutki* is the highest, that the proportion of juar is also large. The area under wheat and grain, on the other hand, forms a smaller proportion of the total in comparison with that in other tahsils.

Location of the plot.—Owing to the general backwardness of the tract, the Department of Agriculture proposed to open a Government Demonstration Plot in that tahsil with a view to improve the agricultural conditions of the tract. The plot was opened in the year 1926-27. The site chosen was the Amarmau village in the Shahgarh tract, which is most backward and cut off from civilization. This village is on the

Saugor—Cawnpore road about 45 miles from Saugor, having facilities of irrigation water from the Chandia tank since 1926.

Objects.—A plot of 10 acres having *Bhatta* soil (which is poor land, raising inferior autumn millets and oil seeds) was taken on a five year lease at an annual rent of Rs. 40/- in the year 1926-27, with the following objects in view.

(1) To introduce transplantation of paddy.

(2) To demonstrate improved varieties of paddy, wheat, groundnut etc, with the aid of irrigation and to follow double cropping.

(3) To demonstrate the advantages of green manuring with sann hemp on soils of light description.

(4) To demonstrate the most economic method of irrigating wheat.

(5) To establish a suitable rotation for the Amarmau irrigated tract.

(6) To advocate preservation of cattle dung and urine for use as manure.

(7) To demonstrate the use of improved implements.

Change of site and improvements effected.—The old plot was located in a comparatively out of the way place and the soil was also very light. It was, therefore, given up and another site chosen in 1929-30, the area of which was 20.40 acres. The soil of the plot is *Patarua* (a sandy loam soil) and is the best available in the village. It was taken on a ten year lease commencing from 1929-30. The area had been lying fallow and was overgrown with *palas* and *ber* bushes. The necessary improvements had to be carried out in bringing the land under cultivation, as is usual, as it is not infrequent that the only plot which is available on lease is one in a run down condition, where the demonstration is as much one of land improvement as of growing of certain crops and the adopting of certain practices. These improvements were possible due to the money provided by the Deputy Commissioner from the *Scarcity Relief Fund.*

A portion of the new plot was brought under the plough in October 1930 and wheat and gram were sown. In 1930-31 the whole area was ploughed in summer to eradicate *Kans* which was in abundance. It, however, disappeared in 1931-32 by further deep ploughing and green manuring, and growing paddy in small bunded areas. The necessary improvements on the plot were completed by the year 1932 after which a regular cropping programme was started.

Outturn of crops and financial position of the plot.—Table No. I shows the yields of some of the crops grown on the plot since 1932-33 and the figures of receipts and expenditure of the plot for the same period are shown in Table No. II. It may, however, be observed that 3.5 to 4.5 acres have been devoted, since the begining, to experimental work such as *Utera* after paddy and cultural and rotational experiments. This entails a heavy expenditure on labour and effects the financial position of the plot. *Utera* crops are mostly a failure. Inspite of this, there is a steady improvement in the financial position of the plot.

TABLE No. I.

Average yield in lbs. per acre of different crops grown on the Government Demonstration Plot, Amarmau.

Name of Crop.	1932-33	1933-34	1934-35	1935-36	1936 37	1937-38
Paddy No. 17 ...	792	967	1944	1544	2100	1830
Dilbuxa ...	576	629	...	...	...	...
Paddy No. 6 ...	650	1250	...	...	...	...
Chhatri paddy ...	...	...	1249	1660	1400	1512
Urid ...	533	299	233	244	32	400
A115 wheat ...	475	438	366	...	...	...
A090 wheat ...	481	453	300	291	851	727
Punjab 8A ...	...	...	...	296	431	580
Gram V ...	945	451	800	901	507	234
Teora ...	273	144	...	...	...	...
Masur ...	67	80	...	...	...	...
Groundnut S. J. ...	...	606	1128	733	1180	...
Paddy varieties of Raipur ...	...	...	..	...	...	3236
Soyabean ...	...	...	...	...	...	1400

TABLE No. II.

Financial position of the Government Demonstration Plot, Amarmau.

Year.	Total receipts.	Total expenditure.	Net profit (+) or loss (–)
1932-33	504 0 0	584 0 0	(–) 80 0 0
1933-34	601 6 3	548 6 0	(+) 53 0 3
1934-35	706 9 0	543 3 9	(+) 158 5 3
1935-36	703 0 6	520 13 9	(+) 182 2 9
1936-37	869 2 3	660 2 6	(+) 208 15 9
1937-38	680 10 3	327 9 0	(+) 153 1 3

Improvement in agriculture of the tract.—The achievement of the object with which the plot was started is best judged by the progress of area under irrigation for paddy and wheat commanded by the Chandia Tank. Before the opening of the Government Demonstration Plot lesser millets were grown by the cultivators of the villages of the Shahgarh-Amarmau tract and paddy was not grown to any appreciable extent. These cultivators are now raising bumper crops of paddy and wheat under irrigation. There is a marked increase in the area under paddy and mung. Double cropping has now become common. Preservation of cattle dung and urine has been zealously adopted and fertility of the soil raised by judicious application of cattle dung and resorting to green manuring. Over 90% of the paddy is now transplanted and improved light ploughs are finding favour. Amongst the improved varieties of paddy, No. 17 and Chhatri have become popular. AO90 wheat is found suitable for the tract and is gaining popularity. Other improved strains of paddy and wheat are under observation. Sakarchini paddy and Pusa 52 wheat seem to be promising, under the conditions obtainable in this tract. The experiments are in progress.

Future outlook and need for further extension of the period of lease.—While the object for which the demonstration plot was started is fulfilled beyond doubt, there is considerable scope for changing the avenue of work to vegetable and fruit culture. The possibility of introducing tobacco cultivation in this region has to be explored, which if found possible, will have a great future, particularly as Saugor is an important *bidi* manufacturing town importing tobacco in large quantities, from outside places such as Gujrat. There is also plenty of scope to popularise the raising of green fodder crops such as berseem and oats in this tract which are so eminently suited for cattle. The conduct of such experiments on the Amarmau plot may adversely affect the finances of the plot, but if the experiments turn out successful, the gain to the cultivators would be enormous.

The ten years lease of the present plot will expire by the end of March 1939. The malguzars and cultivators are anxious that the demonstration plot should continue and now serve as a centre for demonstrating the raising of garden crops. The malguzars who have given the land on lease are even prepared to charge only Rs. 3/8/- per acre for a period of five years instead of Rs. 4/- as previously, in appreciation of what has been achieved by the plot and with the hope that it will serve the useful purpose of demonstrating raising of garden crops. It is gratifying to note that the Mandal Congress Committee at Amarmau

has unanimously passed a resolution at its meeting on the 25th of June 1938, appreciating the work of the Department in this tract and the useful purpose served by the Government Demonstration Plot at Amarmau.

TOMATO

By Dhannalal, L. Ag.

1. Botanical name :—Lycopersicon esculentum.

2. Natural order :—Solanacae.

3. Vernacular name :—Bhedra.

4. **History**—Peru in South America is considered to be the native place of tomato, although sufficient evidence is found of their consumption, long before the arrival of the Spaniards, by the inhabitants of the New World. It was thought to be an ornamental plant only. It would be surprising to many if it is mentioned here that the most highly nutritious parts of tomatoes were considered by the consumers in particular and by some scientists in general as poisonous till the beginning of the 19th century. Afterwards the keen observers carried out some research work in order to find out the economic value of these fruits. It was due to their work that the people could know the high food value and since then its popularity as a vegetable began to increase. Tomatoes are now finding favour practically all over the world although some conservatives still exist in each place. Taking the case of India it has not gained much favour in towns and even among most persons of the big cities.

5. **Soil.**—Tomatoes may be grown on a wide range of soils varying from very sandy loams to heavy clays, provided the drainage is good and there is a fair amount of organic matter. The type of soil does influence the quality, yield and the time of maturity of the crop. Sandy loams will aid early maturity. It thrives best on rich sandy loams which are deep, well drained and open while also being retentive of sufficient moisture to avoid continuous irrigation during dry weather.

6. **Manure.**—The kinds and quantities of fertilizers and manures that may be used with profit depend on the fertility of the soil, the cropping system followed, the returns that might be expected from the crop and the cost of the material used. With low prices for tomatoes and high prices of manures and fertilizers heavy applications cannot be justified. It has been found on the College Farm, Nagpur, that 20 cart loads of Farm

Yard Manure as basal dressings + Ammonium Sulphate 150 lbs. + Super Phosphate 100 lbs. + Potassium Sulphate 150 lbs. mixed and applied before layout or 20 cart loads of F. Y. M. as basal dressing + 150 lbs. Potassium Sulphate + 100 lbs. Super Phosphate mixed before planting+ 100 lbs. Sodium Nitrate top dressed at the planting time+ 180 lbs. Sodium Nitrate at first fruit have given good yields.

7. **Cultivation.**—The land reserved for tomatoes should receive thorough preliminary tillage. After the previous crop is removed or in fallow land, a good ploughing followed by a number of bakharings should be given to the field to produce a fine tilth in the upper soil layers and to destroy all weeds before transplanting seedlings, the field should be divided into beds of suitable size for irrigation. The beds may either be "ridged up" or laid out into what is known as broad ridge method which has been found to be the best for the crop on the College Farm. The land is laid out into ridges and furrows, the furrows are 4' apart and the intermediate space forms the flat ridge 2½' in width. The top of the ridge is levelled and water should first be laid into the beds or furrows and when they are sufficiently soaked, the seedlings should be planted on each side of the ridge at a distance of 15" to 18" from plant to plant on both the sides and 6" away from the border.

On the day previous to that fixed for transplanting the nursery should be irrigated to soften it, so that the root may not be injured while uprooting. The seedlings should preferably be uprooted on the day of transplanting very gently and carefully and kept in baskets with wet mud sticking to the roots.

8. **After-care.**—The land should be kept clean of weeds and irrigated when needed. After each irrigation, the land should be mulched with Khurpi. The crop generally receives irrigation after every week or so and this continues while the plants are bearing fruits. Care should be taken not to give too frequent watering during the period of fruit development.

9. **Irrigation.**—After the first irrigation is given at the time of transplanting two or more irrigations should be applied at close intervals. i. e. 3 to 5 days to enable the seedlings to strike roots. Thereafter the irrigation intervals may be extended to 10 or 12 days until the crop is ready for harvesting.

10. **Support, pruning, and training.**—Various methods of pruning and training are followed, but pruning to a single stem and tying to a stake is the most common one. In this system all the shoots that grow in the

axils of the leaves are removed while they are small. The plants are tied loosely to stake, with plaintain fibre. It should be tied under a leaf stem on the side of the plant opposite to the stem. Sometimes the plants are topped when it reaches the top of the stake. Two or three stems training with desired number of shoots are selected and all others are cut off.

11. **Varieties.**—There are many varieties of tomatoes, but Sutton's Best Of All is the best so far tried on the Farm.

12. **Nursery.**—8 to 12 ounces of seeds of tomato are sown in seed-beds in the month of August and September. 10 to 11 beds of 6' X 3' will give enough seedlings for an acre of land. The seedlings are transplanted in October and November after about six weeks in the field at a distance of 18" from plant to plant.

13. **Harvesting.**—Size is no index of the degree of maturity of tomato fruits. There are three definite stages of maturity generally recognised. (a) Mature green, (b) Pink (c) Ripe. It all depends upon market demands.

14. **Yield.**—It may vary from 6400 lbs to 8000 lbs per acre.

Cost of tomato cultivation on the College Farm, Nagpur

	Rs.	A.	P.	Rs.	A.	P.
(1) Manuring :—						
(a) Cost of 20 C. L. of F. Y. M. @ 1/8/- ...	30	0	0			
(b) Spreading charges. 8 women @ /3/- and 2 men at /5/- ...	2	2	0	32	2	0
(2) Preparatory tillage with bullocks and iron plough ...				5	6	0
(a) 2 pairs of bullocks @ /12/- per pair ...	1	8	0			
(b) 3 men at /5/- each per day ...	0	15	0			
(c) Depreciation and interest ...	0	4	0			
N. B.—It will take 2 days to plough an acre of six inches deep.						
(3) Harrowing twice, levelling, and clod crushing—				1	8	0
(4) 5 Bukherings ...				3	12	0
(a) One pair of bullocks -/12/-						
(b) One man @ -/5/-						
(c) Depreciation and interest -/1/-						
(d) Area 1½ acre i. e. /12/- per acre per day.						
(5) Fertilizers ...				34	11	0
(a) Ammonium sulphate 150 lbs. @ Rs. 5/- per Md. 9/8/-						

(b) Superphosphate 100 lbs. @ Rs. 4/1/- per Md. 5/-
(c) Potassium sulphate 150 lbs. @ Rs. 10/8/- per cwt. 14/1/-
(d) Spreading charges 4 women per day /12/-
(e) Top dressing of sodium nitrate 66 lbs. when first fruit begins to form @ 8/5/- per cwt 5/-
(f) Two female coolies to spread sodium nitrate -/6/-

(6) Laying out the field into broad ridge method by contract Rs. 5/- per acre ... 5 0 0

(7) Cost of seed and the charges for raising the nursery ... 21 0 0

(8) Planting ... 3 1 0

(a) Uprooting seedlings 2 men @ -/10/-
(b) Selection of seedlings 1 man -/5/-
(c) Making holes 2 men -/10/-
(d) Planting seedlings 8 women 1/8/-

Total Rs. 3/1/-

(9) Irrigations ... 26 6 0

(a) The depth from ground level to the water level was 20' to 25', 50 buckets of 1½ gallons raising 3,000 gallons water per hour were used. By means of this Persian wheel, one will irrigate one acre in about 1½ days, working 8 hours a day. Labour units, 1 pair of bullocks -/12/- and 2 men -/10/-. Hence for 9 irrigations the amount comes to Rs. 19/4/-.

(b) Depreciation and interest per acre per annum taking 8 acres to be managed under one Persian wheel costing Rs. 240/- is Rs. 4/9/6-.

(c) Depreciation on well, costing Rs. 400/- is Rs. 2/8/6.

(10) 3 weedings and mulchings :—12 female coolies @ /3/- per day each time ... 6 12 0

(11) One man to look after the crop during the season, proportionate charge ... 2 0 0

(12) Land revenue ... 5 0 0

(13) Harvesting ... 5 8 0

(a) Picking fruits 24 women	4	8	0
(b) Uprooting stocks 2 men	0	10	0
(c) Throwing stocks 2 women	0	6	0

Total cost of cultivation Rs.... 152 2 0

Amount realised by sale of the crop Rs.... 225 0 0

Net profit Rs.... 72 14 0

THE DEVELOPMENT OF THE PLOUGH

By M. A. Rahim, L. Ag.

The dawn of civilization is closely related with the development of the plough. The first step towards civilization was laid when man took a crooked stick and began to till the soil. Some of the earliest ploughs were drawn by men, but later, as animals were trained for draft and burden, animal power was substituted and the plough was enlarged.

Some of the oldest races have left sculptural records on their monuments (3000 B. C.) which illustrate such a plough. Chinese historians say that the first plough in China was made in 2737 B. C. The first use of metal on a plough is unknown but it is recorded that about 1100 B. C. Israelites who were not skilled in the working of iron, " went down to the Philistines to sharpen every man his share and coulter". In the ' Georgics ' Virgil describes a Roman plough as being made up of two pieces of wood meeting at an acute angle and plated with iron.

There was but little improvement in the plough during the middle ages. The first people to improve the Roman model were the Dutch who found that a more perfect plough was needed to do satisfactory work in their soil. The early Dutch plough seems to have most of the fundamental ideas of the modern plough in that it was essentially a wedge-shaped instrument forced through the soil to loosen it. It was provided with a curved breast, beam and two handles. The Dutch model was imported into Yorkshire, England as early as 1730 and served as a model for the early English ploughs. Even though the plough was improved the farmers for some time remained apathetic towards its use due to certain prejudices. In England for example, after experimenting with an iron plough the farmers concluded that the iron made the weeds grow and in America iron ploughs were supposed to poison the soil and to prevent the growth of crops.

In England the first man to improve the plough was Howard who established a factory for manufacturing iron ploughs. James Small of Scotland was another man instrumental in the improvement of the plough. Small's plough was designed to turn the furrows smoothly and to operate with little draft. Robert Ransomes of Ipswitch in 1785 constructed a plough with the share of cast iron. In 1803 Ransomes succeeded in chilling his ploughs, making them very hard and durable. Even today Ransomes as plough-manufacturers are holding their own.

American development.—After the discovery of America, the French settlers used a plough in Virginia in the year 1617. The plough was made of wood with a point of iron. The bullocks were yoked to the plough by their horns. Before the War of Revolution, the ploughs were much like the English and Scotch ploughs. Conditions were not favourable to the development of machinery and tools.

Among those in America who first gave thought to the improvement was Thomas Jefferson. While representing the United States in France he wrote, 'The awkward figure of the mould-board leads one to consider what should be its form.' Later he specified the shape of the plough by stating 'The offices of the mould-board are to receive the sod after the share has cut it, to raise, it gradually and to invert it. The fore end of it should be as wide as the furrow and the length suited to the construction of the plough.'

Jethro Wood is another American who as history relates gave the American plough its proper shape. The mould-board was given such a shape as to turn the furrow evenly and to distribute the wear well. Although Wood's plough was a model for others which followed, he was unrewarded for his work and finally died in want.

The steel plough.—As farming moved farther, the early settlers found a new problem in the tough sod of Prarie States. A special plough with a very long mould-board was found necessary to reduce friction and to turn the sod smoothly. Later, the sod became reduced and it was found that the wooden and the cast-iron ploughs used in the eastern portions of the country would not scour well. This difficulty led to the use of steel in the making of the ploughs steel, having the property of taking an excellent polish permitted the sticky soils to pass over a mould-board made of it where other material failed.

John Lane secured a patent in 1863 on soft centre steel which is used almost universally at the present time in the making of tillage tools. The soft centre steel which was formed by welding a heavy bar of iron between two bars of steel and rolling all down into plates, permitted the steel to be hardened without warping. It is very strong on account of the iron centre which will not become brittle. John Deere and William Parkin were the next who started manufacturing steel ploughs. John Deere are even today the largest manufacturers of ploughs in America.

It is surprising why the Indian plough has to this day remained the same when the Western countries have developed and specialized various

types of ploughs suited to different soil conditions. The logical solution of this is rather difficult to fathom and it is left to the interested readers to have their own conjectures in the matter.

Extracts

COTTON BREEDING IN THE CENTRAL PROVINCES AND BERAR

By D. N. Mehta,

(Economic Botanist for Cotton, Central Provinces, Nagpur.)

Introduction.—Cotton breeding is concerned with the improvement of the cotton plant. Its object is the production of better crops, at no additional expense to the grower. Men of all times have attempted to improve the quality and yield of their cultivated plants. But improvement in the past has, for the most part, been haphazard, accidental and slow. Recent advance in genetics, however, has placed plant breeding on a sound scientific basis and has added considerably to our knowledge of the methods and scope of plant improvement. The plant breeder can now proceed with his task of producing new plants better suited to the many and varied requirements of agriculture and commerce in a systematic and orderly manner. There is little doubt that plant breeding is destined to play a very important role in the agricultural economy of the world.

It is proposed in this paper to trace the development of the cotton plant in the Central Provinces and Berar and to summarize the chief improvements which it has been possible to effect by the application of modern breeding methods. It may perhaps seem purely academic to discuss this subject at a time when the Indian mills are reported to be overstocked with stapled cotton and when, therefore, the grower of the improved types sees but little chance of securing that premium for the superior quality of his lint, on which, the extension of area under such cottons must ultimately depend. It must be assumed, however, that conditions will gradually return to normal and that before long there will be within the country a great increase in the demand for cotton of better staple and quality. In the great central markets of the world, cotton of good grade and staple invariably brings in more than poor, coarse cotton, though the differential is variable. It is therefore not unreasonable to assume that, in the long run, the profitableness of cotton growing in these provinces also will tend to lie in improved cottons of superior quality and staple.

Historical retrospect.—The cotton produced in the Central Provinces and Berar is commercially known as "Oomras" cotton. The quantity grown annually amounts roughly to one-fifth of India's total production of cotton. How long cotton has been cultivated in these provinces, it is difficult to say with any definiteness. Certain it is, however, that at one time the common cotton of the whole "Oomras" tract, was Gossypium indicum or bani which under the name of 'Hinganghat' bani attained the reputation of being the finest Indian cotton. Bani produces far and away the best lint of any truly Indian cotton. Its staple is strong, silky and from 1″ to 1⅛″ in length. "Oomras" to the present day owes its value to the percentage of bani that it contains. Today bani has almost everywhere been supplanted by coarser varieties of the "Neglectum" group. The change was due partly to inherent defects in bani and partly to economic causes. Bani was later ripening than, and not so hardy as, the cottons which threatened to take its place. The bolls on ripening did not open fully at their base and the lint had a tendency to cling to the capsule. It was therefore comparatively difficult to get the whole lock of cotton out of the boll with one pull, with the result, that it took longer to pick than other cottons, while the lint contained small fragments of leaf and septum which increased the blow-room loss. The biggest drawback, however, was its low ginning percentage which in commercial samples rarely exceeded 26. It was in fact, this factor more than any other, which with the prevailing system of disposal of cotton in the "Oomras" tract, proved to be the death-blow for bani. It was Rivett Carnac, in the sixties of the last century, who first drew attention to the fact that 'Jari,' a mixture of cottons of coarse types, supposed to have come from East Khandesh, was ousting bani. He made a serious attempt to check the introduction of this jari but economic conditions were all against him and the hundreds of tons of pure bani seed which he distributed did but little to stem the tide. The cultivator preferred to grow the coarse variety because it was reared with far more ease, was earlier ripening and gave less trouble in picking. The middleman too, preferred it, because he saw in its higher ginning percentage an easy source of profit. The authorities were very concerned about the change that was taking place and made one more attempt to check its spread by the introduction of superior cotton seed of exotic types. The Upland Georgian mixture of from 5 to about 20% which is still found in cotton fields all over the cotton tract of the province is a relic of their achievement in that direction.

How far the inter-mixture of Jari and bani had gone on in the sixties, it is impossible to say, as no classification of our cottons was attempted

till 1906, by which year it was found that Jari had replaced bani everywhere except in Chanda District and on the borders of the Nizam's Dominions. In Chanda District, over a few thousand acres, a more or less pure bani is still grown as a *rabi* crop. The classification carried out by the Department of Agriculture in 1906 showed that about 99% of the cotton area in the province as a whole was cropped with Jari. This so-called Jari on being classified was found to consist of no less than six distinct varieties, namely Gossypium neglectum malvense, Gossypium neglectum verum, Gossypium neglectum roseum, Gossypium neglectum cutchicum, Gossypium indicum and upland Georgian (Gossypium hirsutum). Over the greater part of the province, the white flowered Gossypium neglectum roseum was found to be dominant. Agricultural study of the constituents of the Jari mixture further showed that of the five indigenous varieteis, Gossypium indicum with its one inch staple yielded the lowest amount of lint per acre, while Gossypium neglectum roseum with its coarse short staple and high ginning percentage gave the highest outturn.

As a result of the gradual ousting of bani by Jari, the quality of the "Oomras" began to deteriorate and vary in proportion of coarse varieties in the mixture. To keep the varieties pure, no real inducement was offered by the trade as a whole, for the buyer paid no attention whatever to staple; what he wanted was clean white bulky cotton. The bani *kapas* raised from the seed given out by the Agriculture Department in these provinces in 1904-05 was reported by the growers to have fetched less in the cotton markets than the Jari mixture. There was indication all over the provinces that Jari, for the time being at least, had come to stay.

The great influence played by high ginning percentage and the fact that the highest ginner of all "Roseum" was the easiest to grow practically decided the next step. It was the separating out, multiplication and distribution of pure roseum seed by the Agricultural Department. In this way, the whole of Berar and the Central Provinces to an increasing extent became flooded with this cotton. The natural outcome of all this has been that the bulk of the crop now produced in these provinces is of the shortest and coarsest staple possible—capable of spinning no higher counts than 8's or 10's. There is little doubt that for a time the extension of roseum added largely to the farming profits of the cotton growers.

The growing of a coarse cotton requiring but little cultivation, though a great temptation for the cultivator, cannot, however, be called

sound permanent agriculture on any stable economic basis. It is usually accompanied by soil impoverishment and land deterioration is bound to be followed by crop diseases and other inimical economic factors. This is in fact, what actually did happen in Berar. Tempted by high prices which prevailed during and a few years after the Great War, cotton and still more cotton was grown on the same land without rotation or other considerations of rational farming. Continuous cropping of the land with cotton, led to the incidence of the wilt disease to which the common variety, roseum, proved to be particularly susceptible. The disease began to spread with alarming rapidity and to cause a large loss of revenue to the provinces.

A cotton policy was now, more than ever, needed. With a watchful eye upon the future, the Agricultural Department was not slow to realize that if cotton growing in Berar was to be made a permanent success, attention must be paid to the finding out of cottons of a superior type. The improvement of the race of plants by breeding methods began thus to be considered of the utmost importance. This was perhaps a more difficult and slow method but it was the best ultimate aim and most permanent improvement in agricultural practice. To achieve this object, the Department in 1922 placed the Government Experimental Farm at Akola under the Economic Botanist in order that the work of evolving improved and resistant varieties, testing multiplication, cultural experiments and other essential investigations might be correlated and carried out under one management. In the same year the Indian Central Cotton Committee was formed and laid substantial funds at the disposal of the Agricultural Department for conducting botanical research and cultural experiments for the improvement of the Central Provinces and Berar cotton crop.

Present position.—The new organisation for research commenced work in 1923. The position at this time was briefly this. More than sixty years of promiscuous growing of varieties differing widely in quality and cropping power had brought about a marked deterioration in the reputation of the "Oomras" cotton. As a result of the inter-mixture, the quality of the cotton produced varied from *tahsil* to *tahsil* or even from village to village. For the spinner, it was extremely difficult to obtain uniform lots of cotton of known staple. The wilt menace was on the increase and was driving many cotton lands out of cultivation. The immediate need of the moment was a wilt-resistant cotton which at the same time yielded well. If quality of staple could be combined with it, so much the better.

The first few years were of necessity spent in obtaining pure strains of the various types of Indian cotton and in making a systematic botanical survey of the cottons met with in the provinces. The latter revealed that the existing crop consisted of a mixture of types of great variability to almost every visible character, such as length of staple, percentage of lint to seed, uniformity of fibre upon the individual seed, strength of fibre, size of boll, earliness of maturity and resistance to wilt disease etc. A mixed population of plant showing such wide variations offered great scope for selection. Desirable combinations might, with advantage, be sought in the existing crop. While, therefore, hybridisation and acclimatisation were not excluded from the programme of investigations, it was decided to concentrate on the plant-to-row method of cotton breeding for sure and comparatively rapid progress in the obtaining of suitable types.

The work of crop improvement is necessarily slow in the production of results, because of the many years involved in the selection, fixation and testing of suitable or superior new types. Several years of critical tests are required before it can be safely said that a new strain, no matter how promising, is really better than those already grown. But the period from 1923—1936 has been one of uninterrupted progress and marked advance in the matter of production, development and introduction of new, improved and wilt-resistant varieties of medium stapled cotton which, admirably meet the present-day requirements of the spinner and are at the same time profitable for the cultivator to grow. It is not claimed that in them a complete solution of the cotton problems of these provinces has been found. But the first step in the right direction has been taken. Further improvement will follow in its train.

It was along the lines indicated above that the work proceeded. The existing crop was classified and unit species separated. Rigid selection and testing followed. Of the common acclimatised "neglectum" types of cotton, it was previously supposed that it was only in certain strains of G. n. malvense that any degree of resistance to wilt existed. G. n. verum, though the best neglectum type with regard to lint quality had, up to this time, been ruled out as a desirable cotton on account of its great liability to wilt disease attack. Careful examination of the neglectum cotton types, however, indicated that the most likely type combining a maximum of desirable characters might possibly be obtained from G. n. verum. No work seemed ever to have been done upon the type to try and improve it. Strains were selected and examined but at first they all showed a very high susceptibility to wilt disease. After considerable selection and trial, however, strains of G. n. verum were found showing a

resistance to wilt. It is interesting to remark that at the same time this resistance to wilt was being found haphazard as it were in certain verums hybridisation experiments planned originally with no idea at all of wilt resistance gave a clue as to what resistance to wilt in verum cotton and probably in any neglectum cotton was due. The neglectum cottons have for long been suspected to be a group of hybrid origin. Hybridisation experiments conducted here showed that G. n. verum could be derived by crossing G. arboreum with G. n. roseum; G. arboreum with G. indicum and G. indicum with G. cernuum. The G. n. verum obtained by method 3, although indistinguishable to the ordinary eye from the G. n. verum of methods 1 and 2, yet differs from the latter in being considerably resistant to wilt disease. This resistance to Berar wilt disease and its inheritance in neglectum cottons at all events seems to be always due to the presence of cernuum ancestry. This ancestry can, so far as we have seen, be recognised in narrow cottons by the character of the middle lobe of the leaf. The fact of the two borders to the leaf lobe being slightly doubly convex so that the middle of the lobe expands somewhat instead of the lobe being an isosceles triangle as in other narrow leafed types indicate cernuum blood and wilt resistance. Sometimes the drooping character of the G. cernuum branches is to some degree brought over with the other verum characters; this also is an indication of wilt-resistance. By comparing the verum selections with types derived by known methods, it was possible, in some cases, to assign them a certain method of origin.

Attention was now concentrated on the resistant material of G. n. verum. By the selection of individual plants possessing desirable characters, the degree in which each was able to transmit its desirable characters was determined. Further testing, while increasing separately the product of the best rows, determined which strain was likely to be of the greatest commercial value. Six years of patient experimentation were necessary before the first variety was thought worthy of general distribution. This was verum 262. Being a pure line selection for wilt resistance, it fulfilled the immediate requirement of the time and was a considerable improvement over roseum. With a ginning percentage of 32 and capacity to spin 20's to 22's highest standard warp counts, it gave lint yield which on wilted land was unquestionably higher than that of roseum. Even on non-wilted land the premium it obtained more than compensated for its slightly lower yield and ginning percentage as compared with Jari. In 1929, it was grown over an area of 5,000 acres; in the following seasons, the acreage was 35,000, 1,50,000, 1,64,800,

83,591, 89,560 and 96,000 acres respectively. Experience, however proved this cotton to be susceptible to variations in climatic conditions which rendered estimation of its cropping power a difficult matter owing to wide fluctuation in yield from year to year.

Something more was needed. A cotton that would supplement verum 262 in areas of heavier rainfall to the east of Berar and in the Central Provinces where the duration of the monsoon is comparatively long. In the meantime, the work of breeding new strains was being patiently carried forward on a gradually expanding scale. Further search in the original resistant material of G. n. verum had provided a wide range of new combinations. While the desirability of finding and perfecting a single all-round type for the entire cotton tract, as being the soundest policy both from the agricultural and commercial point of view was at no time lost sight of, all suitable combinations wherever met were isolated and worked up. One of these, now known as late verum, answered the immediate requirements, was multiplied and distributed. Superior to verum 262 in quality and capable of spinning 31's highest standard warp counts, it soon became popular in tracts for which it was developed and has been obtaining a premium of Rs. 10/- per *khandi* over verum 262.

Another useful strain, No. 438, a pure line selection from G. n. verum, followed in rapid succession and has proved valuable for lighter descriptions of soil. While progress of these strains was carefully watched in the field, investigations were continued for the finding out of a strain of cotton which would serve as a good all round type. By the end of 1932, the fixing of such a type became possible and led to the development and multiplication of V. 434, the chief merit of which lies in its adaptability to varying conditions of soil and climate. It is a strain which possesses, in addition to wilt-resistant qualities, drought-resistance, prolific flowering capacity, quickness in forming buds and setting fruit, comparative freedom from shedding and excellent lint characters and good ginning percentage. Its staple is strong, silky and nearly one inch in length. It has been adjudged suitable for spinning 32's to 37's highest standard warp counts—no mean advance over the 8's of roseum and 20's of verum 262. In ginning percentage it rivals with verum 262 and the handsome premium which it commands for the superior quality of its lint, more than compensates for its lower ginning percentage as compared with Jari. The Empress Mills, Nagpur, which tested this cotton along with other growths under identical conditions found that it gave almost the same tension as " Bhensa" cotton, while the blow-room loss was even less. V.

434 is the best all-round type available at present and judging by its rapidly increasing popularity and demand for seed all over the provinces, it should in the course of the next few years have considerable areas under it.

Another aspect of the work has been an examination of the possibilities of buri (acclimatised G. hirsutum) cotton in the Central Provinces and Berar. An area of 50,000 acres in and around Burhanpur in the Nimar District appears to be peculiarly suited to this cotton. Buri yields well in years of ample rainfall especially, and does not suffer from wilt disease. In the cultivators' fields, it is generally met with as an admixture in varying proportions and no doubt improves the general quality of the lint. The lint however, is weak. Systematic work was therefore undertaken to see if it were possible to get a strain that showed any inheritable consistency in its lint strength. Various strains were selected initially with lint strength as one of their desirable characters and they were selfed and thus carried through succeeding generations. As the work progressed, it showed conclusively that the variation in lint strength from year to year was caused by varying environmental conditions. No unifrom improvement in the lint strength could be obtained with local environment. It was therefore decided to restrict work to the improvement of its staple and yield. Intensive selection by the plant-to-row method of cotton breeding was resorted to and is still being carried on. As a result of this work three improved strains, *viz*, Buri Ak. Special, B. 107 and B. 84, have been developed, of which the first two have shown excellent performance and have been taken up wherever buri is grown. In years of heavy rainfall, these strains have yielded as much as 1,000 lbs. of *kapas* at the Akola Farm. Their ginning percentage is 28 and 29 respectively.

Since the receipt of grants from the Indian Central Cotton Committee, a good deal of hybridisation work has also been carried out. This work was somewhat handicapped at first owing to the lack of pure types. The chief aims in this work have been to investigate the possibility of hybridisation itself producing either as hybrids or mutants—new forms of value and secondly, to study the inheritance of independently behaving characters. This work has largely been of academic interest except the hybrids with G. indicum and G. cernuum—some fixed strains of which appear promising and are being multiplied up for field-scale tests. An interesting point in connection with this cross is that considerable quantities of it, whole fields and areas of it at times, are to be found growing in the C. P. No. 1 region and that it is prized for its superior lint and wilt-resistant properties.

The old bani cotton, (G. indicum) too, has not been neglected. This has offered a vast scope for improvement in all directions. But the biggest drawback has been its low ginning percentage. Here we have to contend with the fact that with our Indian cottons as ginning percentage increases the staple gets shorter. Nevertheless, two new strains have been developed, *viz.*, bani 306 and E. B. 31, which are capable of spinning up to 50's and yield up to 500 lbs. of seed cotton per acre. Their ginning percentage is about 27. To these have been added two new strains B 790. and B. 773 which have this year been grown on an acre scale and are a definite improvement on the two previous types. The department will thus be ready with suitable forms when the time comes for the cultivation of bani to be taken up once again. It is realized, however, that until direct contact between the grower and the spinner can be established, until, in fact, the quality of cotton and not the ginning outturn becomes the basis of valuation, there is little chance of extension of area under such superior cottons.

This account will not be complete without a brief reference to the Chanda Jari cotton, a fairly pure cold weather crop of G. indicum. At the time of high cotton prices the area under this crop was about 20,000 acres and it was considered by some that there were possibilities of expansion. The crop was therefore examined with a view to improving it. The first thing required was the eradication of a dirty or tinged strain that was found universally in the crop. A study was therefore made to discover the method of inheritance of this dirty character in Chanda jari and at the same time to test the inheritance of *khaki* colour in other cottons. Our experiments have shown that colour from all gradations from merely tinged lint to markedly drab or *khaki* linted forms behaves as a complementary character with whiteness on straight-forward Mendelian lines. The tinged or *khaki* form is dominant and the whiteness is recessive. The heterozygous form is intermediate in colour and in the case of a tinged form only (like that of Chanda jari) may be of so slight a nature as easily to pass for white to again throw the fully tinged form next year. A pure white good yielding strain has now been isolated and fixed and is being given out for trial and multiplication. The possibility of extension of the Chanda jari crop has also been looked into and it is doubtful in the extreme if it be very great. The present yield of Chanda jari is about 2000 bales and there does not seem much likelihood of this crop assuming great importance by itself. All that can be hoped for, is the substitution of the tinged lint types by the white-linted strain isolated here.

Conclusions.—In conclusion, it is hardly necessary to emphasize that in

no cotton producing area can the crop be improved and that improvement maintained without a wide-spread recognition of the principles of plant breeding and the practical application of those principles. Plant breeding alone, however, will not solve the entire cotton problem of the province. The progress of our improved strains has been undoubtedly grievously retarded by a pernicious practice of buying cotton as *kapas* and paying attention solely to ginning outturn. Under such a system, no cotton of a superior type is going from birth to stand on its own legs without attention. In other words, improvement in the staple by breeding and selection must go hand in hand with improvement in the conditions under which cotton is marketed. The cultivator, too, must realize that to be successful in cotton growing, he should begin with pure pedigree seed and should frequently renew it from the breeding source to prevent natural deterioration and accidental mixing. By the production of a quantity of selfed seed at the Akola Farm each year and its planned distribution in the following two years, facilities are provided by the Agriculture Department for renewal of seed. But while much work has been done in recent years on cotton research in these provinces and while many cultivators in Berar do in fact appreciate the superior qualities of the well-bred cottons, there is still a lamentable ignorance on the part of the majority of growers, of many of the essentials underlying the production of cotton of the highest net money value. There will perhaps always be a demand for cotton of any kind but it is now becoming increasingly evident that competition, stimulation to higher prices will in future lie with cottons of a finer type. There is no good reason why staple cotton cannot be substituted for coarse cotton over the greater part of the cotton growing areas of these provinces. Varieties exist today which are as early and nearly as productive as any varieties of short cotton and which are at the same time adapted to every kind of soil and climate existing in the cotton tract. In V. 434, the Agriculture Department has an excellent all round type to offer to the cultivator, while for certain special areas, there are other strains of equal merit to meet those special requirements. The ideal for which the Berar cultivator should strive for cotton production should be a cotton that would spin higher counts than 20's —*(Indian Central Cotton Committee Paper No. 7)*.

AGRICULTURAL MARKETING IN INDIA

Major A. McD. Livingstone, Agricultural Adviser to the Government of India, read a paper on agricultural marketing in India at the Royal Society of Arts, Indian Section. Sir David B. Meek, Indian Trade Commissioner, presided.

All the marketing work now going on in India owes its origin to the Royal Commission on Agriculture (1928) and we are particularly fortunate that the Chairman of that Commission is now our Viceroy.

The Commission held that the prosperity of the cultivator and his progress in agricultural efficiency depended upon sound marketing and recommended that provincial governments should appoint a whole-time senior officer to investigate marketing conditions. The Commission was satisfied that any expenditure incurred in this direction would be amply repaid.

The first stage of the work consisted of planning a series of marketing surveys in respect of several of the main commodities. In the first year surveys were undertaken on wheat, rice, linseed, tobacco, fruits, cattle, eggs and milk. Other commodities such as hides and skins and coffee were added later, apart from special surveys being carried out on co-operative marketing and markets and fairs.

Grading and standardisation.—The preliminary surveys and the examination of the samples showed that the selling of mixed produce of doubtful quality is a common practice and that adulteration is rampant and seems capable of being practised in connection with nearly every commodity. This not only makes the collection and comparison of prices difficult, but involves unnecessary expense in the handling and transport of worthless goods. Returns to producers are also thereby reduced on account of the higher labour costs in cleaning and sorting the produce at later stages. It was therefore decided to tackle the problem in two main directions, one by the establishment of statutory grades for produce such as eggs, fruit, etc., which are capable of being physically sorted out into different grades at the producing end. In respect of the main staples, such as cereals and oilseeds it was, however, decided to approach the question by arriving at standard contract terms through negotiations with trade associations and for the establishment, if need be, of associations for this purpose where none existed.

To give effect to the policy of establishing statutory grades for certain products the Agricultural Produce (Grading and Marketing) Act was passed

early in 1937, under which powers were taken to prescribe grade designations and specifications of quality in respect of certain articles included in the schedule to the Act. These were, in the first instance, eggs, fruit tobacco, hides, skins, dairy produce, and more recently proposals have been put forward to enlarge the schedule by the inclusion of wheat, ata (wheat flour), edible oils, fruit products, rice, and cotton of distinct botanical varieties.

Rules were drawn up for the grading and marketing of all kinds of produce included in the schedule, and under the general rules of the Act, the Agricultural Marketing Adviser is empowered to authorise approved persons to grade and mark the products subject to certain conditions of control. Marks in the forms of labels, discs, etc., have so far been issued by him to the packers free of charge.

Grading Stations

Efforts to secure better returns.—In order to ensure that the rules and grade specifications would be of a practical character, arrangements were made for establishing and running experimental grading and packing, stations. These were launched also with the object of testing the market for graded produce and to see whether or not producers could, in this way, secure better returns.

Altogether eight or nine grading stations have been started in each case for eggs, fruit and also for ghee. There are four grading stations for hides and three experimental centres for ata. During 1938 another twenty or twenty-five will be started in Provinces and States with the help of the central marketing staff, apart from others which may be commenced by private concerns under certificates of authorisation.

Although some of these grading stations have been running for a comparatively short time produce valued at over 10 lakhs of rupees has already been graded and marked in accordance with the Act. It is very satisfactory to be able to record the fact that in most cases these grading stations were able to secure a premium of from 5 to 15 per cent. more for graded over ungraded produce and the balance in favour of the graded has been over 50 per cent in the case of certain kinds of Kashmir apples.

Costs of distribution.—The grower apparently gets at most nine annas of the rupee paid by the final buyer in the case of cereals and oilseeds. The grower of cigarette tobacco gets only about 44 per cent of the United

Kingdom price. In the case of eggs and fruit the producer gets anything from about 20 per cent to 60 per cent. of the consumer's rupee. The difference between the producers' and consumer's prices represents the total cost of distribution, including wastage, charges for freight, packing, etc. The nature and magnitude of the problem varies with the particular product concerned, but a detailed examination shows that there is ample scope for a reduction in the price margin between the producer and the consumer in almost every case. To reduce this margin, therefore, seems to be the most promising way of securing better prices for Indian producers in the immediate future.

Market charges.—As a rule these charges are very numerous. In some cases the producer has to pay no less than 13 or 14 charges on his produce when he goes to sell it in the market. Apart from octroi and the arhatiyas' commission and also various kinds of charges he has to pay something to the dalal (broker), to the weighman, etc. The total amount of these charges varies and in some cases is as high as 15 per cent of the producers' price. It is not surprising to find that a large number of growers rather than face these numerous charges in the market prefer to dispose of their produce to the local baniya.

The establishment of properly regulated markets under statutory control has led to a reduction in the market charges, sometimes by 50 percent in the Central Provinces, Bombay, Hyderabad State and Madras. The Market Acts in most cases, however, refer only to the establishment of one type of regulated market, say for cotton, so that there is a need for extending their operation in order to cover other types of produce.

Adulteration.—Other factors in regard to price risk which, if they do not tend to enhance the price spread between producer and consumer do certainly lead to the lowering of producers' prices are adulteration and unfair competition. There is in fact not much difference between these two. The analyses of samples which have been carried out show that about 50 or 60 per cent of the ghee is adulterated. This causes consumers to lose confidence altogether and so convinced are they of the widespread nature of the adulteration that they are not prepared to pay for any product a price higher than what they have to give for the competing synthetic or adulterated product. One point of importance is that the sale of the adulterated product deprives the producer of the genuine article of his market. In Bombay, for example, about ten years ago the consumption of pure ghee was about 2,000 tins per day, but now.

adays the amount of pure ghee imported into Bombay City is only about 300 tins per day, although the population is increasing.

Work in Provinces and States

Ministers' interest.—It can be claimed, I hope that although this agricultural marketing work was only recently started in India it has made good progress and the Ministers of the new autonomous provincial governments are taking a really serious interest in its further development on practical lines.

Starting with the North-West Frontier Province, by next year it is probable that almost all the large exports of eggs will be properly graded and marked. Developments for the improved marketing of fruits such as peaches and plums are also under consideration.

In the Punjab apart from introducing a Markets Act for the control of markets and market charges, as already referred to, the local government is undertaking rural reconstruction work in one tahsil in each district and in each case some definite form of improved marketing will be incorporated in the local schemes.

The United Provinces also have in hand proposals for the control of markets and through their fruit development board they have already established a system of approved distributors who are bonded to the government for the sale of producers' produce by auction on a fixed commission basis. Most of the ghee grading stations have been established in this province, which is also active in the grading of hides.

Regulated markets.—In Bengal apart from grading stations for eggs and hides, the marketing staff is co-operating in the establishment of regulated markets for jute and in preparing proposals for the control of markets generally.

Assam and Sikkim have been working on the grading and packing of fruits.

In Madras, which is the important centre for the production and export of high-grade cigarette tobacco, the government has under consideration proposals for regulating the tobacco markets and maintaining the standard of quality. The Indian Tobacco Association was established with its headquarters at Guntur and its members exported in its first year 79,000 lb. of Agmark tobacco, i. e., graded in accordance with

the Agricultural Producing (Grading and Marketing) Act, and this year expects to send about 375,000 lb.

Work has been done also in the way of establishing co-operative societies and a provincial marketing board for the disposal of producers' produce.

The Central Provinces have been doing a good deal in the grading of oranges; and Bombay, too, where steps are also being taken to improve the system of market news and linking marketing developments with rural reconstruction.

Activity in States.—The States are quite as active as the Provinces. In Mysore, for example, where the cultivation of cigarettee tobacco has rapidly extended, steps are being contemplated to control quality through the licensing of flue-curing barns.

Further south in Cochin and Travancore, which previously had a large export trade in eggs with Ceylon, steps are being taken to try and develop an export trade in fresh eggs to other countries and also to establishing a factory for the preparation of liquid and frozen eggs, and for ensuring the rapid collection and despatch of eggs to such a factory through grading and packing stations.

In Kashmir, which is a large and important supplier of apples, the grading and packing of apples in accordance with the statutory standards is being rapidly expanded.

In Patiala State a good deal is being done to improve the marketing of cattle.

Throughout the length and breadth of India the marketing officers are imbued with one idea, namely, to improve the prices obtained by producers in the villages. I hope that these few notes will indicate that their ideas are beginning to take practical shape and are likely to result in the fulfilment of their wish.

IMPROVING INDIA'S AGRICULTURE

That as a result of the activities of the Imperial Agricultural Research Institute there has been a tangible increase in the agricultural income of the farmer, and that even on a fraction of its work the Institute has paid in one year more than what has been spent on it in 31 years is the claim made in an illustrated pamphlet just published on the Imperial

Agricultural Research Institute in which details are given in popular language of the activities of the Institute.

Against a debit of nearly Rs. 282 lakhs which is the sum spent by the Government of India on the Institute in 31 years between 1905-6 and 1936-7 the pamphlet records a credit of about Rs. 425 lakhs, which is estimated to be the increase in the agricultural income of the country in one year (1934-35) from the work of the Institute.

Even if only two of such improved crops, namely, sugarcane and wheat are considered, statistics show that the area under improved varieties of sugarcane increased from 75,334 acres in 1924-25 to 2,445,719 acres in 1934-35.

In 1933-34 an area of 3,419,000 acres yielded 54,472,000 tons of cane giving an all-India average of 15.9 tons of cane to the acre or an increase in yield of nearly 50 per cent. in 10 years. If the all-India average increase in yield is put even at 10 per cent, the increase in 1934-35 alone works out at 2,690,290 tons of cane which at 0-5-0 per maund gives a value of over Rs. 2¼ crores. This is the calculated increase in the agricultural income in the year 1934-35 to the credit of the improved Coimbatore sugarcane alone.

Again the acreage under improved Pusa wheats has been steadily increasing. In 1934-35 the area under improved wheats was 6,489,684 acres or approximately a fifth of the total area under wheat. The all-India average yield for wheat is 7.6 maunds to the acre. While on well managed farms and estates an increase of two maunds per acre over the older varieties can be obtained from the use of Pusa wheats, even if for purposes of calculation for the entire area under improved wheats an increase of only one maund is taken, the increase in agricultural income works out at Rs. 3 per maund to about Rs. 2 crores.

Thus it is that from its work on two crops alone, which represent only a fraction of the Institute's activities, the additional agricultural income to India in one year was about Rs. 4 crores.

Surveying the soil.—Another line of investigation pursued at the Institute has been survey of soils. The need for investigation of soil and fertiliser problems was early recognised. To this end several soils in different parts of the country were examined.

One of the most valuable and practical results of the study of soil fertility in the Institute is the realisation that by judicious soil and crop

management within the means of the poorest farmer, enough nitrogen contained in the air can in the case of certain crops, be put in the soil without buying nitrogenous manures. It should be possible, says the pamphlet, to coax the organisms in the soil to put even as small a quantity as 20 pounds of nitrogen, while under rigorous experimental conditions as much as 360 pounds could be obtained,—and that means a saving of Rs. 8 per acre and an increased crop.

An important and new aspect of recent research at the Institute relates to the influence of fertiliser and manurial treatment on the metabolism and development of plant. It has been found that though the proximate composition of grain and seed may not be visibly altered by cultivation and manuring the ultimate groupings of the final products and their nutritive value appear to vary with the nutrition given to the crop and that intensive cultivation and cropping leads to soil and crop deterioration unless what is taken out of the land is restored to it.

Fighting crop diseases.—Another subject of study at the Institute has been the diseases and pests of crops. The value of crops lost on account of insect pest and diseases, it is estimated, runs into millions of rupees. The Institute has built up a valuable collection of insects and fungi from all parts of India and maintains complete records of their occurrence, life-history, food-plants and the nature and extent of damage which they do to various crops. The collection and the records constitute a most valuable source of knowledge for devising methods for the control of pests and diseases of crops.

Side by side, steps have been taken to bring about a steady improvement of Indian cattle. The importance of this subject was recognised from the beginning and continuous attention has been paid to it. Today there is at the Institute the pedigree Sahiwal herd which is recognised as one of the finest milch herds in India, and its stock is in great demand.

The herd has been gradually selected up from home-bred stock with fresh blood from occasional outside purchases. The average milk yield per cow per day throughout the milch herd has risen from 5 lb. in 1914 to 24 lb., in August, 1937. A considerable number of these animals are giving over 30 lb. of milk per day and a few have attained the level of 40 and 50 lb. a day.

The Institute has all along been giving attention to the problem of reducing loss through farm wastes and has developed several simple

processes and devices within the capacity of the farmer. Simple methods have been evolved for the conversion of farm wastes and crop residues into good manures, for the utilisation of bones as manure without the use of expensive machinery, for the preservation of potato and other vegetables and for producing fine aroma butter and cream.

Experiments have been also in progress for some time to improve the method of gur manufacture, and a simple and efficient method for the manufacture of clean gur has been developed which has attracted wide attention.

Silk worm rearing, cultivation of lac and pure honey were other subjects on which also useful contributions helpful to the peasant have been made as a result of studies undertaken.—(*Times of India*).

RESEARCH IN POTATO SEEDS

It is understood that the Government of Bombay have instructed the Agricultural Department to undertake immediate research work to see that preservable potato seeds are produced in the province.

This is necessitated by the fact that nearly Rs. 9,00,000 of potatoes are stated to be imported from Italy annually, as the potato seed produced in the province cannot be preserved for more than three or four crops. It is gathered that it is cheaper to get Italian potatoes than to get Indian potatoes from other provinces in India.—(*Times of India*).

FRUIT PRODUCTION IN MADRAS

The Marketing Section has completed the surveys of the following fruits, namely, plantains, grapes, pineapples, apples, pears, oranges, limes, other citrus fruits, and mangoes. Some of the salient features in the marketing of these fruits are presented in this note.

Among the several provinces in India, Madras easily leads in fruit production, the area under these fruits during 1936-37 being as follows:—Mangoes 244,945 acres, plantains 132,777 acres, oranges 13,000 acres, limes 8,500 acres, pineapples 330 acres, grapes 250 acres and pears 500 acres. The marketable production, exports, imports and nett available supply are given below:—

(Figures in 000 railway maunds.)

	Marketable production.	Imports.	Exports.	Nett supply.
Mangoes ...	20,000	...	400	19,600
Oranges ...	447	134	20	561
Plantains ...	33,291	...	206	33,085 (as bunches)
Limes ...	1,215	5	117	1,103
Pineapples ...	45	4	...	49
Grapes ...	18	7	1	24
Apples ...	...	13	...	13
Pears ...	215	...	9	206

Mangoes.—Madras Presidency exports annually about 400,000 railway maunds of mangoes, the chief importing provinces during 1936-37 being Central Provinces (83,000 maunds), Bombay (55,000 maunds), Punjab (52,000 maunds), Hyderabad (51,000 maunds), Bengal 41,000), North West Frontier Province (22,000 maunds), Bihar and Orissa (32,000 maunds), Burma (26,000 maunds), Delhi (19,000 maunds), Indore (8,000 maunds) and Sind (8,000 maunds).

The largest exporting districts are Vizagapatam, East Godavari, Cuddapah, Chittoor, North Arcot and Malabar. Except in the case of Malabar which has the advantage of an earlier crop in February-March, mangoes of all producing centres of the Madras Presidency compete in local and North Indian city markets, with results disastrous to exporters in a short producing season. There have been instances when even the railway freight and incidental charges have not been recovered. There is, therefore, need for restricting the extension of mango cultivation of the main crop, and limiting the plantings to choice varieties and to off-season bearers, as in Tinnevelly and parts of Coimbatore, Tanjore and Circars. Expansion of export markets offers one way out of the difficulty, and there appears scope for foreign trade especially as the mango crop is cultivated very little out of India except in Mexico, Peru and Egypt. For the above purpose, cold storage methods with choice fruits are essential. In the already existing trade to North India, regulation of exports by a properly controlled system of producers' organisations, as is being done in America, is a useful step. The Marketing Section has recently organised Fruit Growers' Associations in Vizianagaram, Koduru (Cuddapah District) and Puttur (Chittoor District) to help export trade. The utilisation of the mango and other crops in the preservation industry will be dealt with in a later section.

Plantains.—The plantain crop is next in importance in export trade. The quantity exported during 1936-37 being 206,000 railway maunds distributed among other provinces as follows:

Mysore State (90,000 maunds), Bihar and Orissa (46,000 maunds), Nizam's State (40,000 maunds), Delhi (11,000 maunds), Central Provinces (11,000 maunds), Bengal (5,000 maunds) and Punjab (3,000 maunds), from the Cauvery and Godavari areas. Exports to Mysore State have declined from 130,000 railway maunds in 1934-35 to 90,000 railway maunds during 1936-37, mainly due to increased cultivation in the state. The trade from the Godavari area has moved to places like Delhi and Lahore, due to special reduced rates, recently given by the railways, on the recommendations of the Agricultural Department. The plantain crop offers more risk in export trade than many other fruits. For trade to such a place as Delhi, the railway freight per wagon is about Rs. 800 cost of fruits Rs. 600 and incidental charges about Rs 300 or a total of Rs. 1,700 invested on every wagon. The difficulties in export to North India are greater from the Cauvery area, where the railway freight is Rs. 400 more per wagon. The city of Madras consumes annually about 250,000 railway maunds of Poovan and Rasthali varieties from the Cauvery area, 60,000 railway maunds of Mauritius or green plantains from South Arcot and about 30,000 railway maunds of hill plantains from the Madura hills. Other markets for hill plantains are mainly in Madura and nearby districts, and the prospects of export trade to North India appear remote. Although Malabar is a large producer of plaintains. It is still a nett importer.

In world trade, the importing countries for plantains are the United States, France and United Kingdom, the chief exporting countries being Jamaica, Mexico, Panama and Gautemala. The variety exported is mainly Mauritius under cold storage. In our country, besides reduced rates to North India, for long distance traffic, wooden wagons with ventilators have been arranged for plantains by the Marketing Section, and the extension of such facilities is under consideration.

Citrus fruits.—The area under citrus fruits in the Presidency has increased from 10,000 acres in 1931-32 to about 22,000 acres at present. Still our Presidency is a large importer of oranges, mainly from Central Provinces of Santara variety (74,000 maunds) and of Coorg oranges (60,000 maunds). There is, therefore, scope for increased cultivation both on account of increasing demand and increasing imports. About 65 per cent of the orange gardens in the province are yet to bear fully. The

estimated Madras production by varieties is Sathgudi (96,000 maunds), Batavian (99,000 maunds), Sour oranges (130,000 maunds), other types (139,000 maunds). On the side of marketing of oranges, a Fruit Growers' Association was started recently at Koduru in the Cuddapah District, and sold about Rs. 23,000 worth of Sathgudi oranges last season in Madras city which consumes annually over a lakh of maunds of oranges, comprising Santara (52,000 railway maunds), Sathgudi (33,000 maunds) and Batavian and Kamala (18,000 maunds).

The lime crop also figures prominently in export and about 117,000 railway maunds of the fruits were exported during 1936-37. 80 per cent of which was to Calcutta and the rest to Travancore and Burma. Due to large production, restriction of cultivation at any rate in the larger producing areas is indicated. The consumption of Madras city is annually 32,000 railway maunds of limes. Recently a Lime Growers' Association has been started at Palakol to help in export trade.

Other Fruits

Grapes.—The area under grapes in our province is small and the production of 18,000 railway maunds is mainly of sour grapes from Kodaikanal and Krishnagiri. Consumption is mostly local as in Madras city and Madura and a very small quantity (900 maunds) is exported to North India from Krishnagiri. The grape season February-May has the advantage of production when Northern India supplies are scarce but the main line of improvement is the evolution and acclimatisation of choice types akin to those from Chaman and foreign countries. A Grape Growers' Association has been started in the Madura District and exports to places in Madras and outside are in full swing. In the first one month of the starting of the Society nearly 7,000 baskets (1 basket=25 pounds) of grapes have been marketed in Madras and mofussil centres of the Presidency. International trade in grapes is of the order of 2.42 lakhs of tons annually and the large exporting countries are Spain, Italy, United States of America and South Africa.

Pineapples.—Pineapples are grown in Malabar and Vizagapatam Districts and production is reaching a surplus stage, and comprised Kew (22,000 maunds), Mauritius (5,000 maunds) and local types (17,000 maunds). The wholesale prices range about nine pies per pound in local markets, and from nine pies to one anna per pound in city markets as Madras. Imports are made from the Travancore State.

Apples.—The apple is pre-eminently an imported crop confined to cities and the quantities imported are small compared to our vast supply of local fruits. Apple production in the province is small (70 maunds), and foreign imports amounted during 1936-37 to 9,500 railway maunds of value Rs. 91,800 mainly from Japan (2,650 maunds), South Africa (1,929 maunds), United States of America (1,215 maunds) and Australia (2,418 maunds), besides 3,800 maunds from North India.

Canned and preserved fruits.—On account of our vast production and frequency of gluts in the producing season, there is scope for industrialising our vast fruit resources, in such crops as the mango where production is 9 lakhs of tons, of pears (8,000 tons) and pineapples (1,800 tons). Research investigations on the technique of canning these fruits to suit local conditions and demand have to be immediately taken up. There is also a very profitable scope for the beverage industry in such fruits as limes (50,000 tons), and also of the sour oranges of Guntur (5,000 tons) which in addition to reputed medicinal value makes an excellent squash. Our Presidency imports annually about 2½ lakhs of rupees worth of canned preserved fruits. Even if a fraction of our surplus fruits be canned, the imports will be checked considerably and the grower will get better value during the glut season.

Research.—Improvements in the marketing of fruits should be directed to our immense resources of supply. A planned distribution for choice commercial varieties, restriction of areas in surplus crops as the mango and lime, encouragements of off-season bearers are the lines of attack on the research side. Centralisation of research to suit different fruits and growing areas appears a useful line of improvement. On the side of development of exports, investigations of cold storage methods are indicated for choice fruits in order to prolong the marketing season.—(*Extract from the Hindu.*)

INDIA'S LIVESTOCK

Among welfare movements now being prosecuted in India with increased vigour, that for the regeneration of the country's livestock is not the least important. It is, indeed, fraught with as great potentialities for India's good as any programme of economic or social uplift. The cow has always occupied a prominent place in India's ecology, as well as, in traditional Hindu thought. Unfortunately, the reverence in which the cow is held has not always been translated into practical measures for her management; in other words, animal husbandry has not been raised to the scientific plane it occupies in other countries. There are, however

signs that this state of affairs is changing and that India's livestock is coming into its own. The prime mover in focussing attention on the subject is Lord Linlithgow. Since His Excellency purchased two bulls for presentation to the Delhi District, interest in cattle breeding has grown. The recent All-India Cattle Show was an unqualified success and its continuance on an annual basis is virtually assured. Naturally enough, Lord Linlithgow has had the enthusiastic support of public opinion in his campaign; on all hands there is evidence that a desire to improve the country's livestock is actuating all classes of people. It seems opportune to ask whether, over and above the efforts now being made, the time is not ripe for a reorganisation of our animal husbandry system and its recognition as a vital department in national affairs.

The case for reorganisation is strong. It is perhaps not generally known that the gross value of livestock to India is greater than that of our arable crops. Some years ago an assessment of the annual contribution of livestock in India to Indian economy was made for the first time by Colonel Sir Arthur Olver, Animal Husbandry Expert to the Imperial Council of Agricultural Research, and Mr. M. Vaidyanathan, Statistician to the Council. Their estimates were on a conservative basis, but at the prices then ruling the annual cash value of animal products in India, including the value of labour but not including the very large total profits made in sales of livestock at markets and fairs, was held to be approximately Rs. 1,900 crores. This compares with an estimate, made by other authoritative sources, of Rs. 1,560 crores as the cash value of India's crops. Yet the total amount allotted to animal husbandry work by Governments, Central and Provincial, is little more than half that alloted to arable agriculture. To drive home the moral, there is the further estimate that the total annual provision of funds for animal husbandry work amounts to less than one anna per head of the 150 million cattle of British India. These statistics are striking. They become even more significant when it is stated that the United States of America, with less livestock than British India (181 millions as against 220 millions) provides more than six times the money for their welfare. Justification for this expenditure is shown by the fact that the gross value of animal products in the United States is more than three times that in India.

Animal husbandry is deserving of at least as great consideration as arable agriculture in the Central and Provincial budgets. Experience shows that animal husbandry tends to be treated in step-motherly fashion; when financial stringency occurs and cuts have to be made, livestock improvement grants suffer much more severely than those affecting general agricul-

ture. Frequent changes of policy have militated against the continuity of breeding research, with the result that most of the results obtained so far have been negative. Even so, it is claimed that the animal husbandry work financed by the Central Government has in fact produced a net profit. It is further claimed that were the country as a whole to adopt a forward policy of making the most of its resources in livestock, of improving its breeds of animals and developing its dairy industry on modern lines, the effort would be well repaid.

India is one of the greatest cattle countries in the world. Yet only the other day a report by the Research Officr to the Imperial Veterinary Research Institute at Muktesar pointed out that cattle diseases are ruining India's export trade in livestock. The figures show a drop of Rs. 19 crores in one year—a most serious loss to the country. As Mr. Datta, the Research Officer, says, we must set our house in order. All that India requires to get full value from its resources is scientific management. It is worth considering whether this can be achieved through the patchwork methods now in vogue, or whether it would not pay each province to place all its animal husbandry work under a separate department with experts to guide and give continuity of policy. Such a system, for instance, would ensure that the great impetus to cattle breeding already received from the Viceroy's Scheme would not be dissipated. It is nearly two years since the scheme was launched, and records have in most cases been kept of the bulls presented and their progency. The benefits gained thereby should be assessed and future courses of action laid down. For this purpose it may well be argued that the first essential is an adequate animal husbandry organisation in each province or state.—(*Times of India*).

INDIAN IRRIGATION

All who follow the course of irrigation development in India will read with considerable interest the Triennial Review of Irrigation in India 1933-1936, which is now to hand. The survey is comprehensive and it furnishes a great array of facts and figures. Once again this periodical publication reminds us of the Punjab's lead in irrigation enterprise. That province has an irrigated area of 11,000,000 acres. Madras is second with 7,500,000 acres, and Sind and the United Provinces follow with over 4,000,000 acres each, while Bihar and Orissa combined can show only 900,000 acres. During 1935-36 the Punjab also showed the largest return on capital invested on productive works—14.2 per cent. The

adjacent Frontier Province, it is interesting to note, comes next to the Punjab with a return of 8.4 per cent, the figures for Madras being 7.4, Bihar and Orissa 6.7, and the United Provinces 6.3. But in the percentage of area irrigated to the total area sown Sind leads, the Punjab being second, Madras third, and the North West Frontier Province fourth. Bengal is the only province where the irrigated area is less than one percent of the total area sown—but that is not a matter of wonder. Of the works of importance completed during the triennium by far the largest was the Lloyd (Sukkur Barrage) and Canals construction scheme. The triennium also was notable for the completion of the Cauvery Mettur Project. This was indeed a star achievement, for the Mettur Dam is the largest of such works in the British Empire and is probably the second or third largest in the world.—(*Times of India*).

EXTENSION OF COTTON SCHEMES

A number of subjects affecting the cotton industry and the cultivators were discussed at the half-yearly meeting of the Indian Central Cotton Committee held recently in Bombay, when Sir Bryce Burt, Vice-Chairman of the Imperial Council of Agricultural Research presided.

The Committee approved generally of the bill introduced by the Madras Government for the licensing of cotton ginning and pressing factories, except the clause permitting cotton to be mixed provided it was marked as such.

The decision to publish annual accounts of the work done on cotton in India, the Committee felt, would probably be welcomed not only by those directly engaged in cotton research, but also by those whose interests in cotton were not entirely scientific.

Laboratory work.—The work done at the Technological Laboratory was reviewed, and the purchase of new machinery, including a plant for the control of humidity and temperature at the laboratory throughout the year was provisionally sanctioned. An interim report on the work done in connection with the utilisation of linters, fuzz and cotton waste and similar products for the manufacture of artificial silk, was considered and approved by the Committee.

Among the more important schemes, for the extension of which provisional sanction was accorded by the Committee, were the Madras Nadam Cotton Breeding Scheme, the Punjab Root Rot Scheme, the Hyder-

abad Botanical Scheme, the scheme for the extension and marketing of "V. 434" cotton in the Central Provinces and Berar, the Baroda Scheme and the B. D. 8 scheme in the Bombay Presidency.

Proposals for the extension of the Central Provinces Botanical Scheme also came up for consideration, but it was felt that a general botanical scheme on the lines of the past years was no longer necessary and the Committee, on the recommendation of the Agricultural Research Sub-Committee, approved of the replacement of the existing scheme by two specific cotton breeding schemes, namely, the Central Provinces Cotton Breeding Scheme at Nagpur and the Berar Cotton Breeding Scheme at Akola.

Schemes for the distribution and marketing of "Buri 107" cotton in the Burhanpur Tahsil in the Central Provinces, for the extension of "B. D. 8" cotton in Baroda State and for the maintenance of a nucleus of pure seed of improved strains of cotton in the Central Provinces were among the new schemes provisionally sanctioned.

Foreign trade reviews.—In view of the general interest shown by the trade in the reviews of the state of foreign trade in Indian cotton issued monthly by the Committee, it was decided to make the review a sale publication so as to widen its sphere of usefulness.

In order to test the reliability of the existing standard yield figures for cotton, the Committee accepted the recommendation of the Cotton Forecast Improvement Sub-Committee that the major cotton growing provinces and states should put up proposals for carrying out crop-cutting experiments on a randomised basis for a series of years in a single district. On the basis of specimen inquiries conducted by the Committee in selected areas it was decided to recommend the adoption of the new lower figure of 450,000 bales for extra-factory consumption of cotton in place of the previous conventional estimate of 750,000 bales. The Committee desired, however that it should be made quite clear that the new all-India village consumption figure of 450,000 bales was still a rough estimate and a high degree of statistical accuracy was not claimed for it.—(*Times of India*).

GROWING FINE RICE

For fighting the insect pest.—The United Provinces will soon compete with Bengal in the production of rice of fine qualities. Hitherto the United Provinces have been handicapped in the cultivation of superior grades of rice on account of the prevalence of a certain kind of insect there called 'Gundhi Fly' and the belief had been confirmed among the U. P. cultivators that good early rice must be a prey to the ravages of this 'Gundhi Fly.' The only escape from this fly hitherto was the cultivation of a coarse and poor yielding variety of rice which however possesses the power of resisting insects.

The difficult problem of immunising good rice from the pest is now claimed to have been solved by the successful breeding of a hybrid rice which combines the insect resisting power with superior yield. A hundred and fifty hybrid strains of rice have been bred by the Nagina Rice Research Station under the five-year scheme of research into rice initiated by the Imperial Council of Agricultural Research. These hybrid strains successfully solve the problem of protecting rice from the insect pest. The hybrids produced at the Nagina Research Station are superior to the present variety of rice grown in the U. P. both in yield and in the fineness of grain and are earlier than the types now being distributed. The hybrids have the immunity of coarse rice with the better quality of the other early rices. As a result of the success of these hybrids the United Provinces bid fair to become an important rice-growing centre.

The Nagina Station's work for the past five years has thrown light on the inheritance of various characters which makes for success in practical breeding. It has yielded information on the response of paddy to different manurial and cultural treatments. It has also revealed the cooking efficiency of different types.—(*Amrit Bazaar Patrika*).

ACREAGE DETERMINED BY WEIGHT

A novel method of ascertaining acreages of crops and other vegetation, by using aerial maps, was employed by the Bureau of Agricultural Engineering in surveying the basin of the Rio Grande in Colorado, New Mexico, and Western Texas for the National Resources Committee. A total area of more than 2,000,000 acres was mapped in 18 classifications in a single season, with only a small force and limited funds. The system was devised by F. C. Scobey, of the Irrigation Division, Bureau of Agricultural Engineering.

Practically all the basin was mapped on aerial photostatic prints having a scale of two inches to the mile in the more open country and four inches in the more congested areas in New Mexico. On these prints the fields were readily identified and numbered or coloured according to classification scheme.

To obtain totals of areas so identified, the field maps were traced on clear celluloid sheets, which were then cut up along boundary lines. The pieces for each classification were weighed, in groups, on laboratory balance-scales. These weights were converted into acreages by comparison with previously ascertained weights of templates or accurately dimensioned unit samples of the celluloid.

A pattern sheet consisting of a template of heavy celluloid, representing 1000 acres at the two inch scale and 250 acres at the four inch scale, was cut out and carefully trimmed to exactness with a file, fine drafting scales being used to determine dimensions. One of these test blocks was cut for each field sheet.

A direct check on the weighing, and thus on the summation of areas was made for each field sheet. Before being divided, the piece of celluloid covering the field sheet was carefully weighed. When all the areas and the test block had been broken out, the fragments remaining also were carefully weighed.

The sum of the weights of scraps, plus the group-pieces, plus the test block, had to equal the weight of the original piece of celluloid. A tolerance of 1 part in 1000 was adopted. If the lack of agreement exceeded that ratio, weighings were repeated until the discrepancy was found.

BLOWING BACTERIA TO BITS

Annihilating bacteria by blowing them to bits is the novel achievement of Prof. David Crowther of Columbia University, a process which holds promise of commercial application in the preparation of pathological vaccines and in the sterilization of certain food-stuffs. When bacteria become saturated with carbon dioxide at a pressure of 800 pounds per square inch and that pressure is suddenly released, the bacteria are destroyed and the protoplasm of the cells is liberated in a colloidal form because of the sudden expansion of the gas within the bacteria. Yeast

cells are destroyed with difficulty, but larger organisms, such as weevils and eggs found in flour and cereals are easily destroyed, either by using carbon dioxide, or by a change in air pressure.

The time required for the carbon dioxide to go into solution and to diffuse into the bacteria varies, with the kind of bacteria, from one and a half to two and a half hours. Carbon dioxide is used rather than hydrogen or nitrogen because of its greater solubility at room temperature. The concentration of the bacteria held in suspension in a liquid seems to make no difference. The time required for the saturation of the larger organisms is from one half to one minute at a pressure of 800 pounds per square inch.

The pressure liberates the protoplasm of the bacteria without chemical change, and with certain kinds of bacteria the result is a vaccine superior to that prepared by the old methods involving heat treatment. Where a food product has become contaminated by some organism, complete sterilization is achieved without regard to whether eggs, pupae, or adults are involved. Such a method obviously is applicable where chemicals cannot be used or where they would not readily penetrate. For example, neither heat nor chemicals readily penetrate a package of flour, a bale of cotton, or a bag of seed, but such materials subjected to the pressure of a gas are readily and completely penetrated. In using compressed gas the volume required is only that which is absorbed by the organism and the space between the material treated, provided the material does not dissolve or absorb the gas.—*(Scientific American)*.

CONCRETE MULCH

Back-yard gardens ultimately may be paved instead of ploughed.

The United States Department of Agriculture is now experimenting with permanent mulches of concrete, iron, cinders, zinc, aluminum, and other substances, which cover the surface of the ground, except for a small space where the plants grow.

The experiments, an outgrowth of the successful paper-mulch investigations of recent years, are as yet in their infancy, and the department make no predictions as to their final value. In the tests beans, peas, strawberries, and various other small fruits have grown as well under the permanent mulch as with ordinary cultivation.

Blocks a few inches thick and 9 and 12 inches wide, cover the ground,

with rows 1½ inches wide between them. The permanent mulch conserves moisture and controls weeds. In addition, it warms the soil earlier in the season and keeps it warm longer in the fall. Rainfall gets into the ground along the rows between the blocks. The cinder blocks are covered with asphalt to make them black and absorb more heat, and other material are painted black.

Soil covered with the blocks since 1928 has continued productive. Government Scientists believe it possible that no ill-effects will be found, because they know that trees grow successfully under city streets and sidewalks, which constitute a "permanent mulch."

The Japanese, in certain parts of their country, grow strawberries by using field stones and cement blocks on the ground between the plants, but these are on mountain sides and are placed on a slant. The chief purpose is to force the plants for the mid-winter market, and the system has been in use for several years.—*(Scientific American).*

X-RAY TREATMENT OF SEEDS TO PRODUCE MUTATION

"Evidence is accumulating to indicate that natural mutation, a foundation-stone of evolutionary processes, is primarily due (laying aside secondary chromosome rearrangements incident to natural or artificial hybridization) to the action of natural ionizing radiation produced from such sources as radio-active potassium, uranium, radium, and thorium, and perhaps cosmic radiation, acting in small concentrations over enormous periods of time. The exposure of seeds to X-rays is then in effect the repetition of a very old experiment under more favourable conditions. The time of the experiment is enormously reduced, but the X-ray dosage is multiplied tremendously. Effects, therefore, should be represented by mutations of the same type as those normally occurring. We should, however, be able to improve on nature in at least three ways: by increasing the percentage of occurrence of variations already existent; by emphasizing and carrying to extreme modifications already known in less positive form; and by repeating mutations beneficial to man but detrimental to the plant carrying them—mutations which may have occurred at some time in the phylogenetic history of the plant but which disappeared before man became interested in it, perhaps before man's advent. We have also the very slender chance of producing something really entirely new.

ELECTROCUTED MILK

Pasteurization of milk by electricity is a practical process, according to Dr. C. C. King of the University of Pittisburgh, who recently described the new process before the Electro-Chemical Society. Alternating current is passed through the milk and the entire mass of fluid is easily and evenly heated with a minimum of exposure to either air or metals. Water—cooled carbon-plate electrodes are used and the temperature is brought up in two stages—first, to 120 degree, Fahrenheit, and then to 162 degrees, Fahrenheit. The pasteurized milk produced has been given repeated and thorough tests as to efficiency in destroying pathogenic organisms. The report of these tests have been most satisfactory.

Commenting on Dr. King's results, Dr. Lowy added that there are seventeen plants already in operation utilizing the electrical heating method.—*A. E. B.*

POONA COLD STORAGE EXPERIMENTS

Satisfactory results derived from experiments conducted at Poona in the cold storage of mangoes and other fruits and vegetables have induced the Imperial Council of Agricultural Research to extend the scheme of research for a further period of three years from February, 1937.

It is understood that the main results of the investigations conducted in 1936 revealed that fully ripe Nagpur Oranges, even if not completely yellow, can be kept in good condition for three months at 40 deg. F. without any appreciable wastage: that ripe Malta Oranges can be kept at 40 deg F. in good condition without any wastage for four months.

Packing material.—It was found that wrapping of Alphonso Mangoes with tissue paper spoilt the ripening power after cold storage and that rice straw and wood-wool used as packing material did not affect the Alphonso fruit while in cold storage but spoilt the subsequent ripening to a certain extent.

It has been found that a well ventilated crate of the size of 25 in. by 12 in. by 12 in. capable of holding about 100 Alphonso mangoes is a suitable kind of package for cold storage. Close packing with rice-straw wood-wool, etc and wrapping of individual fruits should be avoided, using only a light wadding of the packing material to support the fruit and to minimise bruising.

It has been discovered that seed-potatoes (Italian) can be kept in good condition without sprouting at 35 deg. F. for twelve months without any appreciable loss of the germinating power.—(*Times of India*).

Reviews

POTASH DEFICIENCY SYMPTOMS

Potash Deficiency Symptoms. By Prof. Dr. Agr. h. c. Oskar Eckstein, Albert Bruno an J. W. Turrentine, Ph. D., with the collaboration of G. A. Cowie, M.A., B.Sc , F. I. C., and Dr. G. N. Hoffer. P. XII +235, including 41 figures and 54 coloured plates. (Berlin ; Verlagsgesellschaft fur Ackerbau M. B. H ; London : Thomas Murby and Co., 1937.)

The book under reference is divided into two parts. The first part deals with (1) general symptoms of potash deficiency as exhibited by the external appearance of the whole plant and its various parts such as leaf, root etc. and the modifications of the inner structure of the plant, (2) secondary effects of potash deficiency such as those connected with the resistence of the plant to climatic factors and to diseases caused by insects and fungi, (3) the relation between potash deficiency and the market value of crops, and (4) the pathology of potash deficiency.

In the second part potash deficiency symptoms of various field crops, fruit trees, and vines have been considered. The most remarkable feature of this part is the 54 coloured plates included in it. These coloured plates have been exquisitely prepared and they bring out very clearly various minute changes (briefly but appropriately described in the text opposite) that take place in plants as a result of potash deficiency. Out of the 45 crops dealt with in these coloured plates, the following are of special importance to our Province :—Wheat, rice, maize, potato, orange, tomato, chillies, cabbage, cauliflower, cotton, sugarcane and tobacco.

The three principal authors of this book who possess a very wide experience of fertiliser problems in general and of potash in particular, have been very successful in presenting in a concise manner a volume of useful and accurate information based on experimental facts as supported by the comprehensive bibliography included in the book.

There is not the slightest doubt that the book in question will on account of its exteremely valuable nature be highly appreciated by agriculturists, research workers, and those connected with the teaching of agriculture. (D. V. B.)

RAFIQ-I-BAGHBAN

"Rafiq-i-Baghban," Saharanpur, is a good attempt to give the cultivators and gardeners a systematic and scientific idea of, growing fruit-trees, vegetables and, other allied subjects. The articles should be as far as possible in simple Urdu so that it may be understood by an ordinary 'mali'. It will be better if the articles at least on technical subjects are properly illustrated. I would like to suggest that a page in the magazine be devoted to give a calender of operations for raising vegetables successfully month by month.

I hope it will be a useful magazine for the Urdu knowing Public, interested in gardening. (M. A. R.)

College and Hostel News

The College Social Gathering is the chief event of the period under report. The programme opend with the musical entertainment by Mr. G. N. Joshi, B.A., LL.B., of Bombay on the night of 2nd October 1938. As expected the popular singer delighted the audience with some excellent song hits.

The sports and atheletic competitions were held on the 4th and 5th. All the competitions were fought with great vigour and splendid spirit. The most interesting items were the bullock race and the tug of war between the students and the staff in which the latter won. From this year Inter Class Tournments in Hockey, Football and Volley-ball are started.

The chief programme of the Social Gathering namely the address commenced with the singing of the National Anthem and the welcome speech by the Reception Secretary, Mr. H. S. Thakur. The Principal, Mr. E. A. H. Churchill, then made a few opening remarks regarding the activities of the College during the past year. This was followed by the General Secretary Mr. V. B. Mandlekar, reading the report of the College and requesting the chief guest of the evening Mr. C. B. Parakh, Advócate, Nagpur to deliver the address. Mr. C. B. Parakh's address was highly illuminating. He began by showing the great value of Agricultural profession to the country and then gave us bis idea regarding the proper education to be imparted in schools and colleges. He laid great emphasis on the necessity of making physical and military education compulsory to every student. The chief guest then performed, the most pleasant part of the evening's programme of giving away the prizes. The following are the names of the recepients.

BEST SPORTSMAN

G. R. Tatwawadi ... IV year.

1.	A Mile Race ...	1.	S. N. Sakalley	III	year.
		2.	A. D. Kane	II	„
2.	880 Yards Race ...	1.	S. N. Sakalley	III	year.
		2.	K. G. Bhide	„	„
3.	440 „ „ ...	1.	V. P. Avadhoot	III	year.
		2.	Raghuvanshi	I	„
4.	220 „ „ ...	1.	C. M. Kekre	III	year.
		2.	V. P. Avadhoot	„	„
5.	100 „ „ ...	1.	Trilochansingh	I	year.
		2.	V. P. Avadhoot	III	„
6.	Sack Race ...	1.	G. R. Tatwawadi	IV	year.
		2.	Y. W. Deshpande	I	„
7.	Bullock Race ...	1.	S. S. Tomar	IV	year.
		2.	Raghwanshi	I	„
8.	Candle Race ...	1.	Trilochansingh	I	year.
		2.	V. R. Deshmukh	III	„
9.	High Jump ...	1.	K. G. Bhide	III	year.
		2.	G. R. Tatwawadi	IV	„
10.	Long Jump ...	1.	Y. W. Deshpande	I	year.
		2.	G. R. Tatwawadi	IV	„
11.	Throwing a Cricket ball.	1.	Trilochansingh	I	year.
		2.	Y. W. Deshpande	I	„
12.	Carrom (Single) ...	1.	S. A. Joshi	III	year.
		2.	V. L. Golhar	II	„

13. Ping Pong (Table Tennis) 1. G. R. Tatwawadi IV year
2. M. D. Patil IV "
14. Bridge ... 1. K. G. Bhide (III) and M. J. Khare (III)
2. S. A. Joshi (III) and C. M. Kekre (III)
15. Chess ... 1. V. B. Mandlekar III year.
2. R. G. Limsay II "

Inter-Class-Tournaments

16. Hockey ... Fourth year.
17. Foot-ball ... Second year.
18. Volley-ball ... Second year.
19. Tug of War between the staff and the students :—

Under the captainship of Mr. E. A. H. Churchill, the staff won the match.

20. Essay writing competition :—
1. S. A. Stevenson I year.
2. R. K. Shukla III "

The evening's programme concluded when Mr. & Mrs. E. A. H. Churchill were at home with the guests. The students and the staff were also served with refreshments.

It is gratifying to note that this year's gathering was a great success. This was mainly due to the perfect co-operation amongst the students, the Staff and the Principal. We owe a great debt to everyone of them specially the Principal without whose sympathy the gathering could never have been such a success.

We are glad to note that Mr. K. G. Bhide, of Junior B. Sc. (Agri.) class has been included in the University Cricket Team. We congratulate him and hope that he will distinguish himself in the contest.

Under the auspices of the Self-Help and Debating Society, College of Agriculture, Nagpur. Mr. G. M. Gokhale, L. C. E. Retired Principal Engineering College, Karachi delivered a lecture on "Religion in Education" on the 1st November 1938.

TRANSFER

Name of officer	From	To.
R. N. Kayasth	Leave	E. A. D., Drug.
V. J. Jamkhandikar	Offg. E. A. D. Drug	A. A. Western Circle.
	LEAVE	
N. G. Sule	Offg. E. A. D. on leave	7 days extension.

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The Nagpur Agricultural College Magazine

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Editorial

LATE SIR SORABJI BEZONJEE MEHTA, K. C. I. E., C. I. E.

Since the last issue of this Magazine, Nagpur has suffered a great loss, by the death of Sir Sorabji Bezonjee Mehta, K. C. I. E., C. I. E.

Sir Sorabji's activities in public life, were too numerous to mention here. He had been a great help to the Department of Agriculture at various times, in their cotton ventures. His connection with the Empress Mills and his knowledge of cotton rendered him very helpful.

He was perhaps best known to the students of the Agriculture College, through the Society of Agriculture and Industries in the C. P. of which he was the member, who represented Industries. This Society is the body responsible for the scholarships known as the V. T. I. Scholarships, at the Agriculture College.

Sir Sorabji will be greatly missed.

B. Ag. CHANGED TO B. Sc. (Agr.)

As is now well known, ~~that~~ the old degree of Bachelor of Agriculture, (B. Ag.) is no longer conferred by the Nagpur University. The new degree is the Bachelor of Science (Agriculture), B. Sc., (Agr.) The first group of students to receive this degree, is that, which passed out in March 1938. It is not necessary to discuss here the reason for the change.

It is necessary however, to say that the names and forms of the new degrees must be carefully noted in order to observe the uniformity in such matters, which is so necessary and desirable. All concerned are requested to carefully note that the degree conferred, is Bachelor of Science (Agriculture) B. Sc. (Agr). This is the Nagpur University form. Nothing else will do. It is not B. Sc. (Ag.), or (Agri)., or (Agric.), or even B. Sc Agr.; it is B. Sc. (Agr). The post-graduate degree is the *Master of Science in Agriculture.* The form of this is M. Sc. (Agr.), and nothing else.

AGRICULTURAL MARKETING IN INDIA

The Indian cultivator receives for the crops which he produces with the sweat of his brow only a fraction of the value which the consumer pays, the difference being eaten away by the so called middle-men, different varieties of whom have established themselves so strongly that they make it impossible for even the more enlightened producers and customers to bargain directly. The existence of middle-men may be traced to the following handicaps under which the Indian agriculturist suffers :—

(1) Want of education,
(2) Indebtedness,
(3) Want of co-operation.

The Indian cultivator being illiterate cannot know what to grow for the world market, what price is being paid for the produce in the big markets, what are the necessary charges incidental to the transportation of commodities grown by him to the market. Want of education makes him place himself at the mercy of the middle-man. Indebtedness is another factor which cannot be ignored. His chronic indebtedness to the sowcar renders it impossible that he should, in matters of selling his crops, be guided by any advice other than those of the money-lender who very often purchases the crops as cheaply as he can from his debtor cultivators. Want of co-operation has always been one of the worst defects among villagers. One cultivator does not trust another even in such matters as selling in the market a basket-

ful of vegetables or a few seers of milk or ghee. Each one of them goes to the distant market, very often on foot, with very small quantities of articles to be sold.

The Provincial Governments have, since a long time been concerned with providing proper facilities to the cultivators to market their products to their best advantage. Good roads, railways, and regulated markets (for instance the cotton markets) have no doubt contributed largely to the expansion of the cultivation of certain crops and certain varieties of crops. We cannot help recalling to mind how during the early days of the introduction of the Verum cotton the cultivators used to get for this esteemed variety even less money for Khandi of kappas than for the rough oomras in the Berar markets. Because the middle-man used to draw the attention of the cultivator to only the low ginning quality and the leafy matter adhering to the cotton in the case of the Verum and never praised its length of fibre or silkiness for which he certainly would be paid a high premium by the mill-owners to whom he sold the same cotton. The day the Verum pools organised by the Agricultural Department C. P. and Berar undertook to take into their charge all certified Verum grown by the cultivators and secure for the growers higher rates, the middleman who to that day was taking advantage of the ignorance of the cultivator had to compete with the Government Verum pooling depots to get the Verum Kappas which was in demand by the mills. His policy therefore of pointing out only the defects to the producer and extol its merits before the mill-owners so that he might purchase as cheaply as possible and sell at as high a rate as possible could not be continued. The Verum growers now know (thanks to the efforts of the Verum Pooling Scheme) that this variety must always fetch a higher price than Roseum or Oomras. Marketing of graded oranges which is being tried at Nagpur promises to earn handsome profits to the orange growers who participate in the Orange Marketing Scheme. The other day one of our enthusiasic agriculturists was pointing out that production of eggs was being considered by him and his

friends round about Chanda, but they were at a loss to know as to what to do with the surplus eggs. With increased facilities for storage of eggs, pooling them and sending them to big markets like Bombay, etc. may be worthy of investigation.

Three years ago the Government of India embarked upon a comprehensive scheme for the improvement of agricultural marketing. All the Provinces and many of the States have co-operated in this enterprise. Surveys of existing methods of marketing of different commodities as a preliminary to future lines of improvement are being carried out and reports of the marketing of six crops have already been released and have been proclaimed to be highly valuable. They are even being translated into Hindi and Urdu. Contract terms have been standardised for the two important commodities, wheat and rice with the co-operation of many trade associations. A large number of grading stations have been established. In the case of tobacco, ghee, eggs, etc., the products graded and sent out by the Agricultural Marketing Schemes, bear the trade mark "Agmark" which serves as a guarantee to the purchasers, and in the case of many Indian commodities it is this guarantee that is necessary to earn the confidence of the customers both within and without India.

The following observations made by His Excellency the Viceroy while opening the conference of Ministers on Agricultural Marketing brings to proper light what this organisation can do for India :—

"Organised Marketing means the application of scientific methods to the problems of collection and distribution. Standardisation, the determination of grades, is more than agreement on convenient categories of physical attributes, size, colour, purity, water or fat content and the like. Standards must be very definitely related to the requirements of the consumer, that is to the saleability of the produce. Standardisation is a pre-requisite of effective advertisement, standardisation, the determination and

strict adherence to grades is a key to distant markets and given improved world conditions—a sure road to expanding business. But marketing organisations can do some thing beyond promoting the orderly and economic distribution and sale of primary produce. An efficient marketing organisation should be the growers intelligence bureau. Often you will find that the cultivator who cannot himself be, in touch with distant overseas markets, will prepare a crop or a particular variety of the same crop, because of it's agricultural advantage, that is because it is easy to grow or because it matures at a convenient moment in seasonal routine of the holding or appears to give a particularly heavy yield. Sometime indeed a variety will be sown in deference to mere local fashion and familiarity. But the marketing-officer who knows the requirements of ultimate markets and the prices ruling in those markets, is quite frequently in a position to advise the cultivator that he will increase his prospects of profit by growing some variety other than that one which seems to possess the highest agricultural advantage. Evidently this function of a marketing service may be of great value in conditions in which world market, in terms of relative demand for different kinds of primary produce is—for one reason or another—in a state of change and uncertainty. A cause so different as the development of synthetic substitutes or the economic aftermath of a war, may substantially promote the demand for one produce at the expense of some other. Consider how much loss could be spared to the grower if his marketing organisation—what I have called his intelligence Bureaux—is able to provide him with very early warning of such a change in demand.

Original Articles

COMPOST—A CHEAP MANURE

By K. R. Narain Singh, Mathur,
(*Director of Agriculture, Jhalawar State.*)

A great authority on Agriculture has well said that given water and manure, crops can be raised on rocks. In India monsoon and irrigation from artificial sources supply the first requisite. The second governing factor is the supply of manure. In order to maintain the fertility of soil we should return to the fields, in any form whatsoever, what is taken out of them as field produce. With the growth of population, all culturable land is brought under the plough. With fewer forests left, the fuel problem is sought to be solved by using dung cakes, thus starving the land. With the increase in cultivated area a greater supply of manure is required to keep up the productive capacity and to maintain the average produce. Whatever small quantity of dung is left it is thrown away in heaps with village sweepings, to be blown away by winds, washed away by rains and desicated by the sun. It poisons the air, and water and adversely affects the health of the village people. Cattle dung, village sweepings and poudrette are directly the life of plants and indirectly the life of planters. Both in the interest of village sanitation and soil fertility, cattle dung should, therefore, be properly utilised.

It has been found that in the supply of plant food ingredients, Indian soils are deficient in nitrates, potash and phosphates only, and the chemists have conclusively proved that the seeds, straw and perished vegetable matter contain the above three essentials of plant food and that they are capable of breaking down into excellant material approximating more or less closely in appearance and in composition to that of cattle dung. To increase the supply of manure which is the governing factor for a rich harvest the Jhalawar Government have been demonstrating on the Rean Basera Agricultural Farm a new method of preparing compost from vegetable rubbish which gives double the quantity of manure in a quarter of time that is ordinarily required for making manure by the heap system.

Since an ordinary cultivator is expected to have at least one pair of bullocks, the following figures are noted to meet his requirements. The size of the pits and the quantity of litter, slurry and water can proportionately be increased according to the number of cattle.

For one pair of bullocks 15 pits of 8 feet by 5 feet by 2 feet each should be made to deposit the litter. Urine is richer in nitrates than

dung, but the cultivators, from ignorance or inability to preserve it, do not try to preserve it. It is made available by putting earth 6 inches deep in the bullock shed over which litter containing waste fodder, weeds straw and other similar organic matter are spread 2 to 4 inches deep every morning and removed to the pit after 24 hours. It makes a comfortable bedding for the cattle and absorbs all the urine which would otherwise make the cattle shed filthy and insanitary. The earth of the cattle shed is turned over once a week to avoid too much packing and to improve its absorbant power and is replaced by fresh earth every four months. The earth which is removed after four months from the cattle shed is stored and used as described hereafter. One pair of bullocks will give sufficient litter to fill one pit measuring 8 feet by 5 feet by 2 feet in six days. When the first pit is filled the litter should be deposited in the 2nd pit which in its turn will be filled in another six days. Thus the cycle of charging all the 15 pits will be completed in 90 days.

On the 90th day when the 15th pit is filled the compost will be ready in the first pit which is then emptied to start the second round of compost making and the compost is stored in a heap, preferably covered with leaves, till it is removed to the fields.

If milk is kept it will get soured or curdled in two or three days but if some curd is added, it will produce the required change within a few hours. The principle in compost making is the same. The main reagent which is capable of bringing about the rapid rotting of all the vegetable matter and thus of producing a valuable organic manure is fungus which is a white substance generally seen on the semi-rotten leaves. If it is introduced into the vegetable matter and air and moisture, which are necessary for its rapid development are controlled, the process of rotting which takes about a year in the heap system of manure making generally practised by the cultivators, is finished in 90 days and gives compost of higher nitrogenous percentage.

With this principle in view the fungus is introduced into the litter in the form of culture solution called slurry which is prepared by mixing dung, ash, urine-earth and fungus matter with water. The earth which is removed from the bullock shed after 4 months is called urine-earth. Any decomposed vegetable matter which has got the whitish substance on it will serve the purpose of fungus matter.

To start the work in the first pit it will have to be brought from any neglected heap of farm sweepings or from any manure pit, the

contents whereof have not completely decomposed. After a few days it will be available from the first pit in ample quantities. About one seer of the rotten vegetable matter with fungus on it mixed with an equal quantity of urine-earth and ash and double the quantity of fresh dung dissolved in a tin of 2 ordinary Gharas (earthen pots) of water will make sufficient slurry to spread over the litter which is daily removed to the pits from the bullock-shed.

To start the compost making, the litter which is ordinarily about 15 cubic feet or four basketfuls per pair of bullocks is collected every morning from the bullock-shed and is mixed with the surplus dung, one basket of urine-earth and a quarter basketful of fungus starter. This mixture is deposited in the pit and treated with a tin of slurry every morning after fresh charging. Some water is also sprinkled over the litter if it is not moist. When the charging of one pit is finished in six days it is left unstirred till on the 12th day, some water is again sprinkled over it and on the 15th day the contents are turned over by a spade and water containing a basket of fungus starter is mixed with it in a quantity just sufficient to make it moist. A fortnight later the litter should again be turned over to give free aeration and thorough turning should be given after a month, i. e. on the 60th day from the day the charging commenced. The pit will need no operation after two and a half months and the compost will be ready in 90 days. The above operation will be continued in every pit till on the 90th day when the last pit will be filled the compost in the first pit will be ready. The first pit is then emptied to start the second round or compost making.

Proper Regulation.—The secret of success in compost making lies in the proper regulation of moisture and air which stimulates the growth of fungii in the pits. Too much water will retard decomposition while the dry litter will take a long time to rot. It is necessary to see that the litter is uniformly moist, the temperature inside the pit is fairly high and the contents are covered with a whitish decomposing reagent fungii. The quantity of water will vary according to the dryness of material and the temperature. Vegetable matter, waste fodder, weeds, sugarcane trash, stalks and all sweepings and refuse would give a fertiliser in 90 days if treated as above.

The owner of a pair of bullocks can annually get by the above method about 50 cartloads of compost of higher nitrogenous percentage than what is generally got by the waste-ful heap system, and since it supplies a greater quantity of humus, its application improves the physical,

chemical and biological properties of the soil which in its turn ensures higher yields.

This useful method of compost-making has emerged out of the experimental stage and is being practised profitably by many good cultivators.

This method costs nothing except the digging of pits where rubbish and refuse will yield gold. India is primarily an agricultural country and the solution of the manurial problem is expected to solve one of India's great problems.

OUR WARDHA EXCURSION

By V. B. Mandlekar, D. R. Vaidya and V. P. Avadhoot.

Introduction.—The Indian National Congress by its resolution at its 48th Session at Bombay instituted the All India Village Industries Association i.e. The Akhil Bharatiya Gram Udyog Sangh at Wardha with a view to promote the welfare of the villages of India. On the 24th November 1938 we visited Wardha to have an idea of the activities of the above mentioned Association.

Some of the important village industries which are being demonstrated in Maganwadi, Nalwadi and Shegaon are as follows:—

(1) Bee keeping.
(2) Paper making.
(3) Oil crushing.
(4) Palm Jaggery making.
(5) Leather tanning.

Bee-keeping.—Bee-keeping is an industry which reqires little outlay, no running expense, no space and no attention from day to day. It can serve as the best subsidiary industry in villages where the conditions are most suitable for the development of Bee-colonies. The vast fields and the blooming hills of India provide ample scope for it. It can give employment directly or indirectly to hundreds and thousands of our people. Honey is obtained; and Bees help agriculture by cross-pollination which is one of the greatest advantages of this industry.

In India there are four kinds of Bees from which honey may be obtained.

(1) Rock Bee.
(2) Indian Bee.
(3) Little Bee.
and (4) Dammer Bee.

The Indian Bee which is accustomed to live in dark cavities with several layers of parallel combs built side by side is fit for domestication for honey production. It is usually found in tree holes, crevices in walls, etc. The Rock Bee though it yields the largest quantity of honey is unfit for domestication as it is very ferocious and the life of the bee-keeper is always in danger. The remaining two varieties yield too little honey and so it is uneconomical to domesticate them.

A colony of bees consists of a mother or queen, several thousand workers and some males called drones. The queen is the only fully developed female in the colony and has long copper coloured abdomen, fair legs, short wings and has a sting which serves as an ovipositor (for the deposition of eggs) when the queen comes out, after the pupation stage. She has her nuptial flight only once in her life and returns to the colony, within a weeks time to take up her position as mother. In her infant stage she is given sufficient room to grow and she is fed by the workers with a special kind of food known as "the royal jelly". Two kinds of eggs are deposited by the queen at her will, both fertilized and unfertilized. The fertilized eggs give rise to the workers and from the unfertilized eggs come the males known as drones.

The workers have a sting as a weapon of defence and offence. They are numerous, and their body is specially adopted for all household work. They collect honey, construct comb, regulate hive temperature, guard the colony against enemies, keep the hive clean and feed the queen and the young ones. They are highly intelligent.

The drones are meant to fertilize the queen. They are killed or expelled soon after this function.

The life of a bee falls into four marked periods, the egg, the larva, the pupa and the adult. The eggs are deposited at the base of the cells by the queen.

Kind of Bee	Time required to reach the adult stage.	Approximate life
Worker	21 days	3-4 months
Queen	16-17 days	2-3 years
Drone	24 days	2-3 months.

The comb is constructed in the shape of beautiful hexagonal cells of wax secreted by the bees. Their diet consists of the pollen grain and

honey, both obtained from sweet flowers carefully nurtured by loving nature under the glorious sunshine. Honey is stored in the top portions of the comb while the bottom is meant for brood rearing. If the workers think that the colony is overpopulated they swarm themselves in parties and produce new queens.

MODERN BEE-KEEPING

Modern Bee hive.—This is a wooden house with two storeys. The lower storey serves as a place for the bees and the young ones to live in and the upper chamber is meant for the collection of honey. The lower chamber has an opening at the bottom of the front plank to let bees in and out. The height of the second chamber is half of the lower chamber. Above the upper chamber is a roof with ventilators to protect the colony from rains and enemies.

The dimensions of the bee hive are as follows, though in different localities bee hives of different dimensions may be tried.

Box—11″ X 7″ X 10½″—8 frames—frame 6½″ X 8½″

Capturing the wild colony.—Having located a colony enlarge the entrance hole and expose several parallel combs. Smoke the cavity to stun the bees. Take out the combs and attach them to the frames. The bees are transferred to the hive by hand or by spoon. They should be gathered and emptied into the hive after carefully noting the presence of the queen.

Rich agricultural districts preferably well wooded with heavy nectar and pollen yielding fruit trees and plants are best suited for bees. The hives should be away from thoroughfares and kept 4-6 feet apart. Protection should be given from their enemies such as ants, wasps, moths, specially waxmoth, lizards bee-catching birds and some undesirable insects. The bottom board should be cleaned at intervals. The bees should not be exposed to their deadly enemies and the bees should not be starved. They could be fed with sugar syrup or honey at intervals when they lack their natural provision.

Extraction of honey.—The local method of extracting honey from the combs by squeezing them is not healthy and does not follow the principle of Ahimsa. The honey obtained is not pure. The centrifugal honey extractor consists of a cylindrical vessel with a conical bottom with a depression in the centre into which a central rod is fixed to which two or more comb cages are attached.

Bees are shaken into the bee broad box, the upper sealing of wax is removed by a blade and the combs are placed in the cage and rotated. Honey comes out and is collected. The combs are returned into the hive for the bees to refill the honey. If the combs are not replaced the bees are required to build new combs. 8 lbs. of honey is utilized for making 1 lb. of wax for the comb.

SOME IMPORTANT FACTS

Extracting season.—February, April and November.

Yield of honey.—Wardha ... 12—15 Lbs. per hive.
South India ... 25 lbs. „

Rate.—Rs. 2/- per lb.

Thus from a hive Rs. 30/- can be obtained.

Cost of one Bee hive.—(Wardha) Rs. 16/-

Life of one colony.—40 years.

Artificial food for bees.—1 part of sugar plus 2 parts water.

Pasture for Bees.—Antigonon, sweet clover, alfa-alfa, coriander, juar, wheat, fruit trees, forest trees, etc.

PAPER-MAKING

Raw Materials.—The chief raw material used in paper making is of a fibrous nature. The useful component of such fibres for paper is cellulose. India produces a large number of fibres in such a variety that paper of every description and sort can be manufactured here. In fact no other country is richer in its fibrous kingdom than India. Inspite of this it is said that India lacks in paper materials excepting a few grasses and bamboos. The village waste like tailors cuttings, old wornout clothes, ropes, baskets, mats or old used thatch grass and such other material altogether useless for other purposes can be used for paper-making. Even waste paper, book binders' and stationery makers' paper cuttings can be turned into paper. The waste of the textiles, the toes of fibres and ropes can also be used. Date palm leaves, cotton stalks, linseed stalks, bark from phalsi tree, old gunny bags, old bamboo baskets and mats, rags, rameta bark, plantain fibre, munj grass have been converted experimentally into paper without any complicated machinery but by simple applicances which can readily be made in villages.

Paper-Making.—The manufacture of paper is both a chemical and a mechanical process. It consists in felting together vegetable fibres into a compact web or fabric. The processes involved are :—

(1) Reducing the fibres to pulp.

(2) Bringing them together to form the web.

(3) Making it suitable for writing purposes by sizing, polishing and cutting.

General Processes of Pulp-Making.—Cleaning, cutting and sorting are first processes. The material should be cleaned of all foreign materials such as sand, dust, nails etc. It should be sorted to bring a uniformity in size. After this the material should be cut into pieces an inch or two in length. It should not be cut too small as it affects the quality of paper.

The second process after cutting is soaking in sufficient water for about a week or two according to the nature of the material or boiling in water or soaking in hot water 2—3 hours and draining off the water. Soaking in water should be done in cisterns or troughs either rectangular or circular and of suitable sizes.

The third process is beating. This preliminary beating of the material is to separate the fibres from knots. This can be done either by pounding the material under dhenki or stamper or by means of wooden mallet in a stone or wooden mortar.

After the material has been pounded it is washed to remove all dirt.

After this preliminary treatment the material is treated chemically for removing all non-cellulose matter of fibres. This is done in three ways:—

(1) Retting or cold process.
(2) Boiling.
(3) A combination of retting and boiling.

After the pulp has been treated chemically it is bleached either by exposing to sun or treating with bleaching powder (calcium hypochlorite) and perchloran. But sun bleaching is not as efficient as chemical bleaching.

Pulp obtainable from various fibres :

Cotton and cotton manufactures ...	80—90%
Bamboo and Munj grass	45—50%
Cleaned plantain fibre and gunny bag ...	55—60%
Sann-hemp	70—80%
Date palm stalk	40%
Date palm leaves	30—40%

Paper Lifting.—After the pulp has been prepared the next operation is paper lifting. It may be defined as the art of mechanically co-mingling or

fabricating by felting together into a continuous or web of sheet of fabric, the ultimate or small units of the vegetable fibres which have been reduced to a suitable condition, and suspended into water.

Pulp having been prepared in sufficient quantity for the required Vat is first brought into a circular Kundi or Cistern in which some water is poured and the pulp is trodden under feet and poured into paper lifting Vat which is previously filled almost to the brim with pure and clean water. The quantity or concentration of the dry pulp in the water should be between 1 to 2 per cent. Next the process of paper lifting commences. After lifting the papers they are placed on a woodden plate and the water allowed to drain off.

Next the paper is lifted sheet by sheet gently, taking care that it is not broken and pasted or struck to the wall for drying by means of a soft brush. The process of lifting sheets of wet paper by means of screens of grass stalks is very interesting.

The dried paper is then collected and given a preliminary polishing with a rough stone as pumice stone or a piece of unglazed tile to remove knots or raw woody fibres if any.

Sizing of paper.—The paper without sizing is somewhat rough and absorbs ink and may be used as ordinary blotting paper. For making the paper non-absorbent the paper requires to be sized. It may be sized in the following processes :—

(1) Starch sizing.
(2) Glue or Gelatine sizing.
(3) Rosin sizing.

Starch sizing.—The starch is made either out of wheat, maize, potato, sago, arrow-root, plantain or weet potato. Generally wheat or rice starch is used. The starch is mixed with water about 12—15 times its weight to form a uniform paste. This is then heated slowly to a thick paste and continually stirred so as not to form lumps. Alum and copper sulphate are also added to the heated starch paste. Next the paper is taken sheet by sheet and the starch paste applied to it on one side by means of a soft brush or piece of cloth or coir and the sheets dried by hanging them on ropes. When one side is thus dried the other side is also treated in the same way.

Glue or Gelatine sizing.—The gelatine is first cut into small pieces, soaked in water and heated till the gelatine goes into solution. To this

heated solution alum is added slowly while stirring. Paper would be soaked in this solution and extra water allowed to drain away.

Rosin sizing.—Rosin sizing is never given to paper after it has been lifted but it is directly added to the finally prepared pulp before the paper is lifted. Rosin soap is prepared by boiling 6 parts of rosin to one part of soda ash and twelve parts of water.

Paper finishing—Polishing and cutting—After the paper is dried and sized it is placed on a concave board and rubbed lengthwise by means of either the stone or the conch shell. Some pressure is required to be exerted. Sometimes it is advantageous to lubricate the stone with a very light film of oil. Polishing or smoothing can also be done by using a heavy dhobi's (washerman's) iron. The paper before ironing should be slightly damped.

After the paper has been polished it has to be cut to the required size. They are cut on a wooden board with a suitable knife.

Blotting and coloured papers.—Blotting paper is unsized paper. Blotting paper may be white or coloured. For producing a white effect in writing or blotting paper, colouring matter such as indigo blue or methyline blue may be added to neutralize the yellowish tinge of the pulp. Generally it is preferable to colour paper with the special class of aniline dyes known as 'direct colours' i. e, those colours which dye cotton goods directly without the assistance of any mordants etc.

Blue—Chinese blue, tannin blue, diamin fast blue.

Yellow—Paper yellow or brillant yellow, sun yellow or chlorazol yellow.

Red—Benzo, Purpuri or Diamin, Dianil Red or Sultan Red.

PALM JAGGERY

There are four palms in India from which sugar or gur could be obtained.

(1) Cocoanut (Nariyal) (Cocos Nucifera)
(2) Sago (Surmad) (Caryota Urens)
(3) Palmyra (Tad) (Borassus Flabelli Formis)
(4) Date palm (Khajur) Phoenix Sylvestris.

Cocoanut palm is cultivated and is confined to the coastal regions where it thrives best. At the age of 12 the tree is considered fit for tapping. Life is about 50 years.

The date palm is cultivated on a commercial scale only in Bengal but it could be grown in all the other provinces. Tapping is generally commenced in the fifth year of its life. The life of the plant is about 40-50 years.

Palmyra was imported from Africa and cultivated in India. The tree becomes ready for tapping after 12 years. The life is 50 years.

Sago palm grown wild and becomes fit for tapping after the 9th year. It yields juice for about 10 years.

Tapping.—This word is used for indicating the method of exacting sap from all the palms. The process of tapping of cocoanut, palmyra or sago palms is the same throughout India. The tapping is done by making a notch in the stem of the plant near the spathe and collecting the juice in earthen pots.

The sap as it trickles from the palm is sweet, but it is liable to ferment in the collecting pots. The sweet sap of the palm is called Nira. Toddy is the fermented sap of the palm. Jaggery or sugar can be made only from Nira and not from toddy.

To prevent fermentation the pots must daily be thoroughly cleaned with water immediately after removing the collected juice, especially in the case of date palm. Besides washing adequate liming of the inside of the pots is the best remedy for preventing fermentation. Smoking the pot after washing it is also useful. The required quantity of the wet lime is applied internally to the collecting pots just at the time of tapping. The yield of the juice decreases with the heat and increases with the cold in the atmosphere.

Though it is difficult to state the exact yield of juice from each kind of palm the following figures may give some idea of their yield.

Daily average yield of juice per tree.

Cocoanut	...	...	3½ to 9 lbs.
Date	...	...	8 to 9 lbs.
Palmyra	...	...	7½ to 13½ lbs.

The effect of liming is as follows :—

	Quantity of Jaggery.
1. No liming ...	Juice fermented, no jaggery.
2. Under liming ...	A little fermentation proceeds and becomes sour, not crystallise properly, jaggery is soft, solidifies slowly and low keeping quality.
3. Overlimed ...	Becomes milky, becomes dark after heating sugar is destroyed and caramlized. Crystallisation slow, jaggery inferior, in quality, and keeping.
4. Properly limed...	Juice is bright and clean and lime settles at the bottom cf the vessel. Crystallisation perfect, jaggery attractive in colour.

As regards the keeping quality of Nira it will remain unfermented for about six hours after collection in the morning if it is not exposed to the heat of the sun. Rise in atmospheric temperature will cause fermentation. Properly limed juice will remain unfermented for about twelve hours after collection.

The juice is collected early in the morning before sunrise and it is subjected to clarification. The juice should be filtered through a piece of cloth for removing the foreign matter that may get into the pots on the trees.

After the juice has been filtered the excess of the lime in the juice is removed by decanting the juice and throwing away the sediment. If the juice is heated to boiling point and then decanted the lime settles at the bottom quickly and thoroughly.

The decanted clean juice is boiled and the scum that rises to the surface is removed with a perforated ladle. Then the gur is prepared in the same manner as in the case of sugarcane.

Yield.—The percentage of jaggery obtained from the sweet juice of each palm is as under :—

Coconut	...	...	12—18	per cent.
Date ...	...	...	10—15	„
Palmyra	...	...	10—15	„
Sago ...	...	...	11	

Economics of the Industry.

Palm.	No: of trees per acre.	Initial capital.	Working capital.	Income.	Season months.
Cocoanut ...	20	10/-	56/-	45/-	8
Date ...	30	25/-	28/-	40/-	3
Palmyra ...	60	15/-	90/-	100/8	4½

OIL EXTRACTION

At Maganwadi they have tried some of the ghanis, examined some others in other parts of country and gathered data in regard to their working. They had selected gingelly seeds for comparison, because gingelly is the only seed which is commonly pressed everywhere in India.

Ghani.	Gingelly in lbs.	Oil in lbs	Percentage.	Charge.	Hours.
1. Pandharpur (Maharashtra) ...	92	24	26	4	8
2. Comilla (Bengal) ...	50	17	34	4	12
3. Bhadrak (Orissa) ...	42	13⅛	31¼	3	9
4. Jallunder (Punjab) ...	40	15	37½	2	7
5. Bhusawal (Berar and Khandesh) ...	43½	17¼	39½	3	10
6. Maganwadi (Wardha)...	144	63⅜	44	8	8
7. Pitapuram (Andhra) ...	36	18	50	...	10

Place.	Seeds in lbs. for one ton of oil.	Crushing cost of one ton oil. Rs. As. P.	Daily out-put of oil in lbs. (shows a day.)
1. Pandharpur ...	8586.7	104 15 6	24.0
2. Comilla ...	6588.2	222 4 9	11.3
3. Bhadrak ...	7168.0	227 0 3	11.1
4. Jallunder ...	5970.3	160 5 0	17.1
5. Bhusawal ...	5648.5	182 9 6	13.8
6. Maganwadi ...	5093.0	51 12 3	63.4
7. Pitapuram ...	4480.0	272 2 0	14.4

If two presses are worked at a time the daily out-put will be increased and the crushing cost will be reduced. So, at present, the Maganwadi Ghani is superior to all in point of daily output, oil percentage extracted, and crushing cost.

At Maganwadi, gingelly, linseed, cocoanut, ground-nut, rape til etc. are pressed and the construction of this ghani is found suitable for pressing all these varieties of seeds besides being efficient in other requirements.

The construction of Maganwadi Ghani.

The main parts of the Ghani are as follows :—

1. The mortar including the cavity and the drain.
2. The stirrer.
3. The pit.
4. The pestle.
5. The curved wood.
6. The weight beam.
7. The beam post
8. The yoke
9. The iron rod etc

The mortar.—The wood of the mortar should be strong, heavy solid, such as will not colur the oil and be readily procurable. The wood that is generally used for mortar at present is that from Tamarind, Neem and Sireesh, occasionally Rayan, Mohowa, Anjan and Babul are also used.

The height of the mortar is about 5½ feet of which 2½ feet is above the ground and 3 feet below the diameter of the mortar being 2 feet. The cavity for the pit is about 18″ deep, 14″ broad at the top, 12″ in the middle and 13″ at the bottom. After the cavity is scooped out immediately above it, a circular margin in the mortar about 1½″ broad and about 1½″ deep should be made in which the stirrer moves to push the seeds into the pit.

The pit.—The pit is that part of the press where the pestle presses the seeds. It is the most important part of the press. The oil percentage, the amount of the oil produced, the time taken per charge etc., depend upon the construction of the pit.

The wood of the planks that make up the pit is generally Babul. In the C. P. sometimes Kusum is also used. There is no fixed limit to the number of planks. Before thrusting the planks the wall of the cavity is plastered with lime and pieces of cloth. After the planks have been fixed a round space at the bottom is left which can be plugged up by a round piece of wood. The construction of the pit should be such that the pestle should revolve in the pit at as great a slant as possible. Besides the slant the pestle should revolve touching

the sides of the pit at most points. The pit gets worn out every 15—18 months and then the planks should be replaced.

The drain.—The drain is to be bored from the bottom of the pit on a side to come out at the other end near the ground. If the wood is defective then a zinc pipe should be made.

The pestle.—Wood of the Babul or Kusum tree is used for the pestle. If the pestle wears out and becomes thin for the worn out pit, it need not be thrown away, but can be used for a new pit which is proportionately narrow. As the wood of the pestle is soaked and seasoned with oil it can be used for the replacable parts of the pit.

Because of the leverage it provides the length of the pestle is an important factor in the efficiency of pressing out the oil and therefore the longer the distance from the fulcrum to the top end of the pestle, the greater the pressure brought to bear on the seeds without bringing any additional burden on the bullock. But it should not be too long as it becomes difficult to handle. From this point of view it is convenient to keep the pestle about 10 feet long, and in order that it may not be too heavy, it should be kept as thin as possible, say about six inches diameter.

The stirrer.—The stirrer is a clever device to brush the seeds into the pit and it is because the stirrer is contrived to work automatically one oilman can attend to two ghanies at a time, conveniently. The stirrer moves over the pit in advance on the pestle. It is hung from a nail in the upright post, where it is tied to the post, an extra load of about ten seers being hung over it to give it force to push the seeds.

The curved wood.—The load of the weight beam that brings the pressure to bear on the pestle is hung on a curved wood which moves resting on the pestle. As that wood moves with the pestle its curve is nearly at right angles. Since it has to carry a big load the wood must be strong. Hence Babul wood is preferable.

The weight beam.—The strain that the bullock has to bear depends mainly on the contrivance of the weight beam.—The length of the beam, its friction with the mortar, the angle that it makes with the mortar, the place of the upright post in the beam, and such others are factors that play their part in reducing or increasing the strain on the bullock.

The longer the weight beam, the easier it is for the bullock to drag it because length furnishes leverage. At the same time the length is a

disadvantage in the sense that it increases the area over which the bullock has to move. Moreover, by increasing the circuit of the bullock, the revolutions of the pestle in the pit becomes less. Thus calculated, the beam should be about 5½ feet long for the bullock and 8 feet long for the camel.

The process of pressing oil.—In the process of pressing oil, addition of water to the charge plays a very important part. The oil-man must acquire the art of knowing exactly how much water to add and when to add it.

About three fourth the seeds that are put in one charge are allowed to be crushed first, keeping the remainder on the top of the mortar. After about five minutes when the seeds put in the pit comes up, they are pushed back into the pit and about 25 tolas of boiling water is added, 15 tolas sprinkled in the upper part. Then after about ten minutes when the powder becomes dry another lot of about 15 tolas is added in both the parts of the pit, and the remaining seeds are mixed with the powder. Again after about 15 minutes when oil appears and the powder begins to be formed into cake the last portion of water, about 20 tolas is added. After this the oil is allowed to accumulate in the pit.

To avoid the rancidity in the oil, common salt, dried in the sun or upon fire should be added to the oil in the proportion of 5 to 6 per cent and the oil should be allowed to rest for about a week. This will make the cake residue to settle down, when pure oil can be gently poured into another vessel leaving the settled powder at the bottom.

THE TANNING INDUSTRY

Another industry worth paying attention to is the tanning industry in Nalwadi called the Gosewa Charmalaya. The industry got a good start and is now threatening to compete other tanning industries financed by foreign capital. In spite of the fact that India contributes about 20 per cent of the world's production of hide and skin she has to look to other countries for her need of leather articles. This is due essentially to the dearth of Indian capital.

The processes followed are devoid of complication. The hide is soaked in lime tanks for a day or so in order to facilitate the removal of the hair. It can also be soaked in common salt solution, to hasten the process. Finally it is dried and pressed. The popular chrome leather is prepared by soaking the hide in potassium dichromate solutions and sulphuric acid which act as reducing agents in the chemical reaction.

The bye-products of this industry form the many important commercial articles. Flesh manure is assessed a high manurial value since it contains 11.5 per cent of nitrogen. Glue, guts and gelatine are also important bye-products.

Seemingly we came to the end of our tour. But we were yet to see the half naked Fakir, the exponent of Khadi, the saviour of the Harijans. The sight of the lonely huts there, and the snow white cows roaming on the green pasture that stretched the country side recalled to our mind the Ashrama of our Rishis who lived thousands of years ago. The surrounding was enveloped in a pleasant but solemn atmosphere. From a hut came the Mahatma to give the pleasure of his 'darshan'. He was accorded a hearty welcome by us with shouts of Mahatma—ki—jai.

Along with the low sun in the western horizon we wished the Mahatma good-bye. The birds were returning to their nests to enjoy the well earned rest, the cattle to their shed to lick their young ones, and the cowherd enveloped in the dust was already seeing children before the mind's—eye. Night was gradully casting it's black veil over the earth. Everything was still and calm and the pleasures of our trip came to an end, for the pleasures are like poppies spread, you seize the flower, its bloom is shed or like the snow falls in the river, a moment white and then melts for ever.

We heartily thank Messrs Chitre, Parnerkar and J. P. Patel for the kind guidance they gave us at Wardha.

USE OF LINSEED FIBRE IN THE VILLAGES OF CENTRAL PROVINCES AND BERAR

By D. P. PERSAI, B. Ag.

Introduction.—Linseed is grown in various countries for either of the two purposes, seed or fibre. Russia and Ireland grow it chiefly for fibre while India, U. S. A. and Argentine grow it for seed purposes only.

Experiments have been conducted with success in the past to extract fibres from linseed in several Indian Provinces, but it could not be a practical proposition chiefly on account of the following two factors :—

(*a*) Attempts were always made to obtain the best material for which seeds of flax were to be imported every second or third year from foreign countries and this, being a costly affair, did not appeal to the cultivators.

(*b*) Costly machinery which requires investment of a large capital and also skilled labour to handle them were recommended.

That means it was not a practical proposition for the cultivators of India. But since a simple, country method which neither requires the help of costly machinery nor great skill (in other words within the means of ordinary cultivators) has been developed for extracting fibers from linseed stalks in the laboratory of the Oil Seeds Specialist, C. P. Nagpur (Agri. College Magazine Vol XII No. 3 pp. 178 and Vol XIII No. 1 pp. 18-19); the question arises as to how far it can benefit the cultivators in villages. For this purpose a survey of village, Gujarwada in the Hoshangabad District and Thasil, has been undertaken. This will act as a rough guide to all villages in C. P. and Berar where linseed is grown. The following details have been collected from actual observations.

Necessity of fibre in the village.—Fibre is very necessary in the village as various articles of Agricultural use are made out of it. Fibre is used for making ropes for tying cattle. Fibre is required for drawing water from wells etc. Thus fibre is an indispensable material to the cultivators. Some of the important articles commonly needed are shown below.

(1) **Girma.**—Girma is needed for tying cattle in the cattle-yard.

(2) **Dorna and Paghaiya.**—Dorna and Paghaiya for yoking bullocks into the bakhar or plough.

(3) **Kasan.**—Kasan is used for tying in the cart wheat, gram or any other crop, kept one over another, to guard against their falling on the way while in transport.

(4) **Lej.**—Lej is used for drawing water from wells.

(5) **Jot.**—Jot helps in yoking the animal to the cart, bakher or plough.

Amount of fibre required in the village annually:—I have already mentioned the important articles made out of fibre which are a necessity to the villagers. In the village under consideration the following articles are required annually which nearly need 4330 seers of fibres.

Name of article.	No: of articles needed	Wt. of each	Total Wt.	Remarks.
1. Girma.	3990	½ Sr.	1995 Srs.	3 for every animal per year.
2. Jot.	596	¼ "	149 "	2 pairs per plough.
3. Dorna and Paghaiya.	298	1 "	298 "	1 pair per plough.
4. Kasan.	149	5 "	745 "	Every cultivator has one.
5. Lej.	762	1½ "	1143 "	Every house requires 3 strong lejes annually.

Total 4330 Srs.

Money spent on them.—At present the following fibres are generally used by the villagers in preparing these articles but mostly they are prepared from Sann-hemp :—

(1) Sann-hemp (Crotolaria Juncea).
(2) Ambadi (Hibiscus Cannabinus).
(3) Bark of trees like Khakhara (Butea Frondosa).
(3) Baber.

Assuming that everying is made of Sann-hemp the money spent in purchasing 4330 seers of the fibres may be estimated to be Rs. 721/10/8 (at 6 seers a rupee) as the village does not grow Sann-hemp.

Amount of linseed fibre that can be extracted in the village.—The acreage under linseed is nearly 580 acres during 1937-38.

Experiments conducted so far give, on an average 80 lbs. of fibre per acre, seed rate being nearly 20 lbs. Nearly 23,200 seers of the fibre, can, therefore, be produced in this village.

The amount of material needed for the whole village is 4330 seers annually and the expected production of the linseed fibre is 23,200 seers. This leaves a surplus of 18,870 seers, if linseed fibre is exclusively used in place of other fibres for preparing the different articles, which can be sold or used for other purposes such as the making of yarn carpets etc.

THE ASHRAM GOSHALA, SHEGAON

By Y. M. Parnerkar.

The supply of pure hygienic milk has always been a problem in India both in rural as well as urban areas, specially for those that look upon the article of diet for good health. With us this question was still more serious as we insist upon taking milk and milk products from the cow only.

Ours is decidedly an agricultural country. Cattle industry has a great bearing on our rural economics. It is the main stay of the farm. In a vast country like India where nearly half of the people do not take animal food, milk and milk products should take an important place in their dietary. All the farm power comes from the bullocks we maintain. It is nearly impossible for our poor country to feed two sets of animals, one for milk, and the other for power and then waste half of the progeny. A brief study of our breeds of cattle will show that it is quite possible to get both milk and bullocks from the cow alone. Hence only cow keeping should be encouraged if the prosperity of the farmers is to be regained.

Shegaon and the villages round about are very very poor in cattle, both in quantity and quality, with the result that the children are under-nourished for want of milk and the lands are imperfectly cultivated for want of bullocks, the crops are starved for want of manure and all these go to increase the poverty and misery of the poor cultivators. We therefore decided to encourage cow keeping in this part and began with a vow to use only cow's milk and ghee in the Ashram. But cow's milk and ghee as a part of every day food was a new thing here. The current belief was that cow's milk is only meant for the sick and for babies that do not get enough milk from the breast of their mothers, and that cow's ghee is a medicine and not a food. It was not possible to get these articles in Shegaon. Inducing the farmers to milk their cows was not an easy job. The cows are so much deteriorated that it was hardly possible to draw out an appreciable amount of milk. Getting milk from Wardha was out of question. Milk has to go from villages to cities and not from cities to villages. So we started our Goshala with a couple of cows purchased locally. The results were encouraging and as the demand increased more cows were added with the result that we have now a herd of 18 adult cows and their progeny led by a pure bred bull.

While purchasing new cows for our herd we had to decide about the breed to be maintained. India—specially rural India has to take up

to duel purpose animals. In every locality where some sort of breeding is practised the local breeders have developed or at least maintained a breed most suited to the locality. From the little experience we had, we found that the local Gaolao cows, if well cared for, will make suitable animals for the village needs. The results of our Goshala are encouraging. A typical bull of this breed has been secured from the Government Farm for breeding purposes.

There is no grazing area worth the name. A few patches are lying waste along the nallah. These were secured on two years lease. The place was then cleared up of the shrubs and other undesirable growth and is now serving us as grazing ground for our cattle. These plots are unfit during the rainy season, but we can cut grass for summer feeding, graze the cattle during winter and use other high lying areas during rains. The grass is of poor quality and the lands being on lease no permanent improvement is possible. We had to purchase some plots which were then temporarily fenced and quality of the grass is being improved by seeding, weeding and judicious grazing.

In a tropical country where the temperature goes up to 115° and more it is not possible to secure substantial grazing throughout the year. The animals have to starve in the latter part of winter and all through the summer. The pressure on land is increasing. Many crops are finding favour with the ordinary cultivators. It is now high time for us to think about the fodder crops. Without growing fodder or fodder yielding crops no improvment in cattle is possible. A smaller fodder farm is therefore attached to our dairy with a view to study fodder yielding crops suited for this locality.

But all this will not go to improve the lot of the farmers. We get good milk, and turn out a few well bred animals. But is this all? Out of the many strong forces that go to increase the farmers poverty, the weaning of the cattle industry from farming is one that has not yet attracted the attention of workers in this line. Cattle keeping must be an integral part of farming and should not be an independant occupation. Under the existing conditions cheap milk can only be produced by the farmer who can rear and use his farm produced animals, make the best use of the manure, and turn his waste fodder into rich milk. Some day even city milk supply will have to come from the adjoining villages and not produced in city stables.

But how could the cultivator of Shegaon be induced to keep good cows and more cows? The local cows are very poor animals. Grazing is not

enough and free and they are too poor to invest anything. If they keep some good cows and sell the milk they would get some money for the weekly market. And so it was decided that the Ashram should purchase whatever milk they produce even at high rates. We began with one or two farmers but were soon faced with the milk-adulteration problem. Along with the milk we had to pay for the dirty water added. Personal supervision was not possible. Milking the animals in the Ashram compound meant that this was to be limited to Shegaon alone. So we decided to pay on test basis. The composite sample of milk from individual farmers is tested for fat and the money is paid every week. But there is still another side of the difficulty—adulteration with buffalo milk. So we have to depend upon the strict supervision we are carrying out and then as a rule we do not purchase milk from anybody who keeps any other milking animal other than the cow.

All this milk is not needed for the Ashram consumption. We could establish a business by supplying milk to Wardha, but what about the seven lakhs of villages that can have no cities nearby to serve as markets? Hence we took up to the production of ghee. We have been able to produce good quality of butter and ghee with only a separator, country churn, and other local accessories.

Skim milk we do not waste. Some of it is used in feeding the calves of our Goshala, some is re—sold to the farmers for their calves and the rest is used locally. The buttermilk is supplied to the servants for whom this is the only milk stuff available.

One thing has been noticed, that when we began to pay on fat basis, the farmers realised the value of good feeding and on the whole the cows are now better cared for than before. The separated milk has been a boon to the young calves, otherwise they were sure to be undernourished.

The enthusiasm of supplementing their income by keeping cows is checked to a great extent by the want of capital. Purchasing cows means money. From the beginning we are against advancing money and then getting involved in troubles. How can other village workers in this line have any money for advances? But something was to be done. We started a Gosudhar Fund. The farmer, who supplies us milk, contributes—as deposit—two annas per rupee of milk money and we put in an equal amount. From this we advance them small sums to purchase cows. We have also a store of concentrates from whence they may purchase their weekly supply.

The village had no bull. We have now secured a montgomery bull from the Government Farm. This bull will impart its milk strain and then we will revert back to Gaolao. All the scrub bulls have been castrated. The feeding of the bull is the Society's job.

The price at which we sell the ghee is pretty high but we do not believe in underselling a thing. Under Shegaon conditions selling ghee cheaper than Re. 1-2-0 a lb means exploitation of either the cow or the owner of the cow. Exploitation means discontent, hatred, subducation, class war, and what not and so it is Himsa. Business based on Himsa will never be stable.

We have not been able to do any big business. It is only a few lbs. here and there. One reason for this being the lack of trained workers. For any village industry that is to be established in a particular locality it is essential that we must have local workers. Outside workers may help in establishing it but the final burden should always rest on the shoulders of the local people. It is one of the most difficult of jobs to get trained people in villages. They have been kept in darkness for ages and the city life is so fascinating that the young man as soon as he knows anything about the world rushes to the city. Village life has no charm for him.

Shall we look forward to a day when the student of agriculture will foregc the allurements of city life, burn to ashes his superiority complex, abandon the high hopes of lucrative jobs and sacrifice other so called city pleasures and throw his lot with poor farmers and do his bit in serving those for whom he is primarily meant !

Extracts

THE COLLECTIVE FARM SYSTEM IN RUSSIA

By Dr. Harold H. Mann

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The story of co-operation in Russia has been different, both in its history and in the final form which it has now reached, from anything that has happened in any other country in the world. It began about the end of the last century on lines similar to those in other countries and although it was distrusted by the Government of Imperial Russia, yet it developed very rapidly. Before the great world war the co-operative societies numbered at least 27,000, chiefly for the supply of agricultural credit. The Communist Revolution in 1917, destroyed almost the whole of the previous structure, specially so far as credit societies were concerned and what was left became for the time being practically a State Department.

A reaction took place in 1921 with the re-creation of the Co-operative Movement. So far as agricultural co-operative societies were concerned at this period, the members were individual peasants, and they were very largely used for the purpose of combined purchase or combined sale. In the palmiest days of the 'New Economic Policy,' as it was called, the number of members of such societies became over eleven millions or about half the peasant population of the country.

A new epoch, however, opened in 1928, and, since that time, while ordinary co-operation, as we have known it elsewhere has tended to decline, the organisation of communal agriculture has gone further than in any part of the world and has been conducted on co-operative lines. The extent to which other forms of co-operative work have declined can be judged by the abolition of the urban consumers' movement in 1935—a form of co-operation which, when I first went to Russia in 1930, seemed universal and seemed likely to absorb all shop-keeping in the country.

But rural co-operation, centered round the collective farm, has developed marvellously, though with many changes of policy, many setbacks, and at one stage a narrowly avoided collapse,—till it has become almost universal, either in the form of the collective farms themselves or in the rural consumers' movement which acts as a buyer of agricultural produce. In the present article I will limit myself to an account of the organisation and working of the collective farms themselves, both as recorded in published reports, and also as I have seen it myself in the country.

It is well known that the ownership of land in Russia has been in some sense communal throughout the whole of history. It was only in the second half of the 19th century, that the idea of peasant ownership came in the front. This being the case the transformation to a collective system, though full of difficulty, was not nearly so revolutionary as it would be, for example, in India, where individual possession of land has a very long history and is very deep-seated in the minds of the rural population. All the same, one of the first results of the Communist Revolution in 1917 was the seizure of almost the whole of the agricultural land by the peasants. The large estates of the landlords were split up and, in spite of Communist theory, it looked as if the whole land would become a mass of individual peasant holdings, though of course the community as represented by the State, demanded a much greater share in the produce than the State had ever taken before.

This continued, as I have already said, until 1928, when a genuine attempt was made to reconvert the mass of individual holdings in a village or similar area, into a communal holding. At this time however, there were a good many different views as to what the nature of the communal holding should be, how far it should go in taking account of all the possessions of each peasant, how far the area should be treated as one, and also how far the management should be unified. There were some, in fact who wished that everything possessed by the peasants should be communalised, that is to say, should be treated as belonging not to individuals but to the community as a whole. Some went so far as to consider that no peasant should hold individually even his house, his poultry or a milking cow. There was a time when it appeared as if this view was likely to dominate the situation but it was always resisted by the peasants over the greater part of the country, and the result of attempts to enforce it led to the slaughter of a very large proportion of the livestock in the country in 1932 and the early part of 1933. I fancy indeed that the whole of Soviet system came more nearly to a breakdown at this time than at any other period of its history, largely owing to the resistance of the peasants to the complete collectivisation of property which was demanded.

As has so often happened during the re-organisation of Russia since the Revolution, the authorities realised the dangerous position of things in the early part of 1933, and a very famous decision was made at this time largely under the inspiration of Stalin, whereby individual ownership was recognised over a very large part of a peasant's possessions. He was encouraged to have a milking

cow of his own; to possess chickens and small animals of similar kind; to have a cottage and surrounding garden which belonged to himself; while at the same time the general agriculture of each collective unit continued to be run on a communal basis. The result is that at the present time it is estimated that four per cent of the rural land in Russia (1935) form the private gardens and other lands belonging, individually, to the members of collective farms.

From 1933 the organisation has become fairly stable, and I think it may be said that the collective farm system of Russia is now well understood by the peasants, and works (at any rate in a fairly successful season) with no more friction or trouble than is the case with the agricultural organisation of a more old fashioned country. This result has, however, only been achieved by a very close co-operation between the State and the collective farms. Unless the State had been prepared to invest an enormous amount of capital in making it easy for the collective farms to work, and unless it had, moreover, been prepared to make the success of the collective system one of its primary purposes, I am sure that the present organisation could not have reached success. In fact, I feel (as a result of my Russian observations) that, if any country wishes to develop a collective agricultural system its Government must make this a primary purpose of its existence and must be prepared to invest capital and energy in the struggle to make it a success, which is far beyond anything which seems to have been realised by any Government in the world outside Russia.

Let me now try to describe the organisation of a typical collective farm in Russia at the present moment. The area of such a farm may include one or more villages and its area may run from say 234 acres up to 12,000 acres, though over a greater part of the main corn-growing tracts of South Russia a collective farm will usually contain somewhere from 2,000 to 6,000 acres. Usually, the collective farm is made so as to include one or more villages and there has been very little cutting up of the old villages in order to make more convenient collective farms. In 1934 the average area per household in collective farms amounted to nearly 16 acres of which it was stated that nearly 13 acres were under grain or similar crops. Naturally this figure would vary enormously over different classess of cultivation and over different parts of the country, but the figures I have given are to give an idea of what is aimed at in these farms. Owing to the demand for labour in the rapidly developing industrial system in the towns and also for extending agriculture into new tracts in Siberia and elsewhere, the area per household has tended

to increase since the collective farm system was first organised about 1928. It must be realised at once that in a collectivised village a peasant must either join the collective farm or cease to hold any land at all beyond the garden attached to his own house. Membership, however, is not a right of any inhabitant of a village and members can be expelled by the general meeting of the collective farm and new members likewise admitted even from other villages.

Such a collective farm as I have described is now a legal constituted body and will have received grants of land from the State, which are to be devoted to its use for ever. Its property includes the arable land and the common grazing ground of the village, central farm buildings, work animals, implements and the common herds of cattle, pigs, sheep or poultry.

The collective farm is governed by a small committee, elected from their own members for two years. The land is worked without reference to its previous ownership in the most economic way and the actual work of the farm is carried on by "brigades" each under a leader appointed by the committee. These "brigades" contain both men and women, while the care of livestock is usually a matter for the men.

But it must be clearly understood that the cropping of such a collective farm is not entirely at the option of the committee. Each collective farm receives each year from the Government a plan specifying how much grain and similar crops is to be grown, while for cash crops they are expected to grow a definite minimum of each of the products for which the place is suitable, for sale to the State factories. In fact, a contract has to be entered into at the beginning of each year with the State factories specifying the minimum amount for which any individual collective farm will be responsible.

An agricultural expert appointed by the State is usually, though not always attached to a collective farm and his advise will normally be taken, though the committee, are not compelled to do so. Further, in a greater part of Russia the State has established what are called Machine Tractor Stations and, from these, implements and tractors can be hired which are beyond the capacity of each collective farm to purchase for themselves, and seed and manures can also be obtained from them. The use of all the implements for the production of a crop including the use of tractors, will usually be charged at about one-sixth to one-fourth the normal yield of the crop grown and this will be paid for in kind.

The crops are, therefore, grown by the members of the collective farm with the assistance of seed, manure and implements as well as advice obtained from the nearest Machine Tractor Station. When each crop is ready for harvest the whole is reaped and remains at the disposal of the Committee, of the collective farm. From the products so obtained the charges incurred in its production, including the land revenue payable to the State, have first to be set aside. In fact, the order in which the produce is disposed of will normally be as follows :

(1) Delivery of a fixed quantity of grain or other crop per acre amounting to about one-sixth of the average yield to the State. This might be considered as a form of land revenue, but it is rather in the nature of a forced sale at a price which is only a fraction of that obtainable in the market. In the great grain-growing area of the Ukraine the amount of grain delivered under this arrangement amounts to about one to one and a half maunds per acre. It is a fixed amount based on the average yield.

(2) The payment to the Machine Tractor Station for supplies, of the manure, seed and advice, together with the hire of implements during the growth of the crops.

After these two payments have been made the rest of the produce belongs to the collective farm. Such a proportion of it as is necessary to pay the cash requirements is sold in the market collectively, and out of the money so obtained the following items are paid for (1) the subsistence wages of the members of the collective farm which have been paid during the growth of the crop, or other wages due to the workers. I will deal with these wages later; (2) the agricultural tax payable to the State and amounting to about one fortieth of the cash income; (3) all costs of production other than those due to the Machine Tractor Station; (4) the administrative costs of the collective farm which must not exceed 2 percent of the cash income, (5) the purchase of equipment designed to increase the production of the collective farm, and (6) any other expenditure for the improvement of the collective farm which is decided upon by the general meeting.

The whole organisation is simple except so far as concerns the wages payable to the workers on the collective farm during the production of the crops. To subsistence wages paid during the growth of crops, is added the amount which is earned by the worker according to the quality of his work, so that a small amount will be payable to each worker during the growing season and, it may be a larger amount at the end of the year when the produce has been sold. The calculation of the

amount due finally to any individual worker is one of the most interesting features of the collective farm system. All farm labour is divided into seven groups according to the quality of the work done. In the highest of these groups which includes the best workers on the farm, each day's work is counted as two "labour days." In the lowest grado, on the other hand, a day's work is only counted as half a "labour day." This unit of labour represents the amount which might be expected from an ordinary good labourer without special skill. If the amount of work done or the quality of work improves, worker will be advanced to a higher group. If, on the other hand, it declines a worker may be put down to a lower group. The whole decision in this matter being made by the Committee of the collective farm.

After the payments which have been mentioned have been made the whole of the remaining produce is divided among the members of the collective form who can store it or sell it or use it at their own free will. Most of it is, I fancy sold to a rural co-operative society and this is the method which is generally favoured by the state authorities. Though there is no restriction on private sale of produce, yet it must be understood that this cannot lead to the growth of a private merchant's business because any such business is not permitted. If the sale, in fact is not made to a co-operative body it can only be made, at least in theory to an actual consumer.

The general system which I have described has not been reached all at once, and it is quite possible that the organisation has not reached its final methods. Up to the present there has been such a demand for labour in connection with the new industrial development in Russia that there has been no pressure of population in the villages but, on the other hand the tendency has been for the number of members of any particular farm to decrease. This may not always be so and if the amount of land per member decreases it may bring back poverty again where the collective farm system has temporarily removed it. The safeguard against this is represented of course by the enormous undeveloped areas in Russia, to which any excess population can go and will be able to go for many years to come, where every assistance will be given to new colonists who try to make an agricultural country from an undeveloped waste.

It will be seen that the system, if properly worked, should lead to the most efficient working of the land within the area of a collective farm, and as a result the actual production from the land is now tending to rise quite rapidly. To obtain this result, of course, means an enormous

State organisation to assist the collective farm to make the best use of its land. Experience in Russia, as elsewhere, has shown very clearly that there is no magic in the conversion of a large number of small scattered individual holdings into a collective farm. In fact, experience has shown that the production of such a collective farm may be less than that obtained by the members working each on his own holding. It is only where there is good leadership and satisfactory knowledge that the desired end can be achieved. And it would astonish anyone who has not been to Russia to see the amount of energy and training which has been expended in order to obtain the necessary amount of village leadership and to make available the requisite skill to the collective farms. In the absence of these two necessary things the collective farm system almost collapsed. With their gradual improvement and the consequent increase of production, the whole system seems to have passed beyond the critical stage and is now likely to become a permanent feature of rural economy in Russia.

I have not time in the present article to discuss the extent to which any similar scheme of collective farming is suitable for India. There are many difficulties in addition to those which have been met in Russia. Some of these are the intense pride in land ownership and all that this involves, the absence of undeveloped areas to anything like the same extent as in Russia into which the excess population could be drafted, the absence of industrialisation of the country to anything like the same extent as has been attempted in Russia, and finally, the existence of a large "middle-man" class whether existing as landlords, private merchants, money-lenders, etc., all of whom had to be "liquidated" in Russia before the collective farm system could be a success. Unless these difficulties can be met and got rid of I do not think that the success of any collective farm system in India is likely to occur. Whether they can be got out of the way, except in a revoluntionary period, is matter on which opinions may differ. But if these hindrances can be met, I think there is something to say for the collectivisation of agriculture as a means of improving the standard of life of the rural population in India, and the raising of the rural communities out of the abyss of bankruptcy in which they now lie.—*Indian Co-operative Review.*

EGG PRODUCTS AND PROSPECTS

Owing to the dislocation of industry in China by the Sino-Japanese war, a rare opportunity is offered to local enterprise in India to capture some of the world markets for egg products of which China has been the chief supplier in the past.

It appears that enquiries are being made by manufacturers into the possibilities of making these products outside China. India, with her comparative nearness to the consuming markets of Europe, could easily step into the breach and capture an important industry.

Uses of egg products.—Egg products, frozen, dried or liquid, are mainly used in large bakeries and hotels, and commercial manufacturers of foods, for example, ice-cream, candies, confectionaries, food beverages, mayonnaise, etc, utilise them for making up large receipts by weight or volume. The whites are also used in industries for clarifying wines, leather-tanning, preparation of adhesives and of photographic films. United Kingdom is an important consumer of egg products, where the liquid eggs and the yolks are used mainly for confectionary and cooking, and the whites for industrial purposes.

During 1936 for which latest figures are available, the c. i. f. price at London for Chinese frozen eggs was £48 per ton. When import duty is added to this, the figure comes to over £52 per ton.

Now the current average price of Indian hen eggs in shell weighing about 10 lbs per long hundred (120) at the Indian ports is 3s. 3d. From this about 11 per cent has to be deducted for the weight of the shell. This works out to be £40 6s. per ton of liquid hen egg (without shell but unfrozen), delivered at Indian ports. Similarly the price of duck eggs weighing about 14 lbs. per 120, delivered at the Indian ports is 3s. 1d. After deducting the weight of shell the cost of liquid eggs (unfrozen) works out to £27 7s.

Frozen eggs and cost.—The hypothetical cost of freezing and transport per ton comes to about £8. Thus our frozen hen eggs could be landed in London at £48. 6s. per ton and the frozen duck eggs at £35. 7s. per ton. Compared with the Chinese frozen eggs, the prices of Indian frozen eggs would in such cases be less by £4 7s. 4d. per ton in the case of hen eggs and £17. 6s. 4d. in the case of duck eggs.

A factory handling say two tons of hen egg products per day, would have a net annual margin of over £3,000 or over Rs. 40,000 to work upon which is nearly 75 per cent of the initial capital outlay. On the other hand, the processing of duck eggs leaves a much wider margin per ton to work upon, and the development of this branch of the industry is worth a special study. In India already, of all branches of poultry keeping, the keeping of ducks is most specialised, in as much as in concentrated areas of production, the keepers have large flocks ranging from 500 to 1,500 ducks.

Factory for freezing eggs.—The freezing or drying of eggs requires a suitably equipped factory and scientific control of conditions. The estimated cost of a factory having say, two ton freezing capacity per day and suitable cold storage space, is about Rs 65,000. But this could be reduced considerably if the work could be taken up by some of the existent cold stores or ice factories at the ports. To produce daily two tons of frozen products a regular supply of about 60,000 fresh hen eggs or 45,000 duck eggs is necessary. This should be readily forth-coming from concentrated areas of production such as the Eastern Bengal and Travancore and Cochin States, if the producers could be assured of a regular demand and the collections were properly organised.

Estimates for costs of a factory for dehydrating the eggs are not available, but since the processing is not to be done under frozen conditions, the plant would be comparatively cheap. The same would be the case with transport charges in ordinary conditions.

Adequate study of the qualities of Indian eggs and their proper selection and collections on the one hand, and practical experience in the management of the factory on the other, appear to be necessary, if the enterprise is to be successfully undertaken in India.—(*Amrita Bazar Patrika.*)

COTTON TRADE IN INDIA

World position.—Reviewing world cotton trade, Mr. Niranjan Prasad said that the year was a record one in the matter of the world's total crop of raw cotton. This record crop, combined with the recession in business activity that had already set in in America and the world since 1937, brought down the prices to new low levels. The world consumption also did not keep pace with the larger crop. The statistical position of Indian raw cotton was much more favourable than that of American or Egyptain cotton. The crop was smaller than in the preceding year and the consumption, particularly in India, was on a higher level. Indian mills consumed 2,994,000 bales as compared with 2,625,000 bales in the preceding year. The U. S. A. crop was larger in quantity and also better in quality.

At the same time, for several months during the season, Indian cotton was selling higher in parity with American, resulting in loss of ground for Indian cotton in Japan and the Continent, accounting for a large decline in export. Import restrictions and exchange, inaugurated by the Government of Japan to meet the exigencies of the Sino-Japanese conflict, reduced her takings by nearly half.

Speaking about the raw cotton crisis in India the speaker remarked that with very little prospects of a material revival in world consumption, and with the present huge carry-over, the position particularly remained as at the commencement of the last season. Unless something very extraordinary happened, there was every probability that prices would continue to remain at low levels. Cotton being the chief money crop of India, the situation was, indeed embarrassing. Relief, therefore, should be sought in increasing the consumption of raw cotton within the country itself and by reducing transport and handling costs and Government dues. "We have to reconcile ourselves to the record crops and the low prices. Our Government can give relief in other directions such as exchange policy and railway freights."—(*The Hindu*).

VITAMIN "A" AS CURE FOR NIGHT BLINDNESS

Night blindness, or inability to distinguish light in the dark, has been cured completely in 20 minutes. By subjecting himself to dietary experiments at Harvard University, an American, who normally enjoys excellent vision has established the connection between this complaint and the sufferer's diet. Throughout the experiments, which lasted several months, careful note was taken of the man's powers of vision, and startling changes were reported.

First, for 6 weeks, he lived on a perfectly balanced diet augmented by daily doses of vitamin A. His eye-sight, tested regularly to ascertain the least amount of light he could detect in a darkened room remained at a very high level of efficiency, as was expected.

Then his food was changed suddenly. All items rich in vitamin A, such as milk products, eggs and certain vegetables, were eliminated from his menu, and the daily extra dose was stopped. Within 24 hours his sight was affected in the dark-room tests, and at the end of 25 days on the impoverished diet his vision had so deteriorated that 50 times as much light as originally perceived was required before he could detect anything.

Then came the cure, carotene, the colouring matter in carrots, very rich in Vitamin A, was injected directly into the subject's muscles. At the end of 7 minutes an improvement was noted; in 20 minutes the cure was complete.—(*The Hindu.*)

THESE COWS LIKE THE RADIO

On at least three English dairy farms the cows are milked to the accompaniment of music provided by the radio. Their sheds are fitted up with loud speakers. This is not the latest eccentricity of an animal crank. The owners of the farms have found that it pays. The cows have given improved yields and have won many important awards at

shows. The programmes are carefully selected, jazz and swing music being barred.—(*The Hindu.*)

INDIAN COTTON FOR GERMANY

An important deal is understood to have been successfully negotiated by the Berlin office of the Federation of Indian Chambers of Commerce and Industries with the German Government whereby, it is expected, the German Government will purchase Indian cotton in excess of their normal quota by nearly 20 per cent.

The Secretary of the Federation at Berlin, informs the United Press that according to the terms and conditions of this agreement, the German Government are agreeable to purchasing through the Federation of Indian Chambers of Commerce and Industries 100,000 bales of Indian cotton in excess of their usual annual import during 1939 provided the Federation make it possible for the sale of German machinery for industrial purposes of the same value.

The significance of this deal, will be evident from the fact that the amount of German import of Indian cotton has gone down from 209,924 bales in 1931 to 144,776 bales in 1937. This has taken place in spite of the fact that the total import of cotton from all countries into Germany has greatly increased during the same period. All countries with which Germany has trade agreements and clearing arrangements are, it is evident, gaining ground in Germany at India's cost. If this cotton deal is successfully pushed through, it will increase the value of the Indian cotton export to Germany by nearly 20 per cent.—(*The Hindu*).

MOLASSES FOR ROADS

The annual production of 394,099 tons of molasses in India can be converted into road surfaces at a cost of ten annas per square yard, which compares with the present cost of fifteen annas for tar-macadam roads and Rs. 3-10-0 for cement roads.

There is great scope, for the development of molasses roads in India, since the main ingredients required, namely, molasses and coal tar, are available in unlimited quantities—molasses from the 150 sugar factories and coal tar and pitch from Jharia, Raneegunj and the C. P. coal fields.

The latest researches, have shown that 'molassed roads' have the same capacity to sustain heavy loads as tar-macadam roads. For the production of this new material the first step, is the installation of small tar-making plants in the different provinces, preferably near the sugar factories so that tar may be supplied to the road contractors without incurring any excessive transport charges. From the average

total of 394,099 tons of molasses produced in India annually, Dr. Sen, Biochemist of the Imperial Institute of Sugar Technology calculates that every year 6,870 miles of good roads can be constructed.

The Sen Process as it is known consists of the carrying out of resinification in the presence of an acid catalyst. In the first place molasses are dehydrated by progressive thickening till the temperature rises to 135 degrees centigrade and it can be drawn into strings. The resulting substance is then acidified until its solubility is reduced to a minimum. The acidified molasses are then resinified with a mixture of coal tar and asphalt in the presence of acid.—(*The Hindu.*)

CUT FLOWERS LIVE TWELVE MONTHS

An American professor has discovered a method of prolonging the life of cut flowers. Instead of fading in a day or two, flowers have been made to keep fresh for weeks and months, in some instances for a whole year. First sterilised with quarter-strength bromine water, the flowers are placed in a mixture of agar-agar, (a jelly-like substance prepared from certain sea-weeds) sugar, and various mineral salts. Under this treatment, flowers not only retain their freshness but often continue to grow. New roots develop and new plants form.—(*The Hindu.*)

ANOTHER SUBSTITUTE FOR RUBBER

Efforts to provide substitutes for raw materials which have to be imported from abroad continue to be made in Germany, Italy and Japan, and to a lesser extent elsewhere. From Italy comes news of yet another substitute for rubber. This time it is a synthetic product made from skins of tomatoes.

It is not yet known how far this latest discovery of the Italian research chemists will go to satisfy their country's rubber requirements. The skins of 400 tons of tomatoes are needed to make a ton of this artifical rubber. As the Italian tomato crop is estimated at 400,000 tons a year not more than 1,000 tons of the new "rubber" can be produced, even if every tomato in the country is commandeered for the purpose. The world's total production of natural rubber is approximately 800,000 tons. (*The Hindu.*)

HOW MUCH DO YOU EAT IN A LIFETIME

Diet experts estimate that the average individual eats about 50 tons of food in his lifetime. They say that for every pound that the normal person weighs he consumes something like 700 pounds of food before he dies. Of course some people manage with much less than the average; others put away a good deal more.

There was the celebrated case of the Venetian who lived to be 102 on 10 ounces of dry food and 6 ounces of wine a day. There was the Arab officer who would eat a baked sheep, 10 fowls and 10 pounds of sweetmeats at a single feast, and who won a bet by eating at one sitting a calf weighing several hundred pounds.—(*The Hindu*).

SLUDGE AND THE GARDENER

The word sludge has in itself an unpleasant sound and one dictionary definition is" a muddy or slimy deposit from sewage".

By suitable modern methods the slimy deposit from sewage can be converted into inoffensive plant-food known and valued by the gardener as humus.

Sludge is a waste-product of modern civilization. The sewage problem is essentially the sludge problem. Means have been devised to effectively purify the liquid portion of the sewage so as to discharge a harmless effluent into a river or stream. The "slimy deposit" still remains to be dealt with. Before applying to crops crude sludge must be oxidised; otherwise many crops excepting coarse feeders like cabbage will suffer. Transportation is also difficult. It must be converted into humus.

When sludge is incorporated with the soil in reasonable proportions the micro-organisms of the soil soon act upon it and it loses its slimy nature and becomes ultimately converted into humus. The same process takes place when sewage is oxidised in various forms of artificial filters. The most intensive form of oxidation results in the production of what is known as "Activated Sludge". In the so-called Activated Sludge Process of sewage purification this material is built up by systematic and scientifically controlled artificial aeration in tanks. The sludge so obtained when in throughly good 'condition' can be drained and dried out readily and used as a brown humus-like product containing some 5 to 6% of Nitrogen 2% to 3% of phosphoric acid besides 60% to 70% organic matter. It is thus a very valuable organic manure. Certain cities in America have produced this material in large quantities. At Milwankee. U. S. A. it is sold as "Milorganite" and at Pasadena, California, as "Nitrogenic Fertilizer". There is no real reason why this should not be done in other big towns. But only certain difficulties in the necessary drying operations have hampered progress in this direction. But these are now rapidly overcome.

There is little doubt that when activated sludge is generally available in an easily marketable form, guarnteed free from weeds and deleterious organisms there will be a great demand for it, more particularly on the part of the gardeners., as it has shown to have qualities excellently suited for lawns and golf screens and for general garden purposes, especially the cultivation of roses. Where concentrated activated sludge of the above composition is difficult to produce a form of activated sludge or humus

can be obtained by fermenting together ordinary sludge, deposited in sewage settling tanks and town refuse or "Kutchara". The resulting product known as "Activated compost" has in fact been successfully manufactured on a large scale in India by fermenting together of town refuse and actual fæcal matter at such centres as Mysore, Indore and Bhopal.

In England this process has been applied to the fermentation of town refuse and ordinary sludge from settling tanks the operations being briefly as follows:—

(1) Refuse sorted, glasses, bottles etc. separated. (2) Ashes are separated from organic matter. (3) Pins, razor-blades etc. are separated by magnets. (4) The remaining organic matter is pulverised and falls into bays and is trimmed to receive wet sewage sludge containing up to 98% water. One ton of pulverised organic matter refuse is stated to receive two tons of wet sewage sludge. (5) The mixture is thoroughly turned and aerated by a mechanical shovel which deals with half a ton at a time. The compost is turned every four or five days and within 21 days complete dehydration and digestion of the sludge is said to take place. The heat generated destroys all weeds and deleterious organisms. The resulting compost is an excellent manure for market gardens and for loosening heavy land. It however, seldom contains more than 1% Nitrogen and perhaps about the same percentage of phosphoric acid.

In the foregoing way it will be seen that from modern towns provided with a sewage system or even from smaller communities where dry conservancy still prevails it is possible by suitable means embodying well recognized biochemical principles to produce large quantities of valuable humus which should be a boon not only to the landscape gardener or the ordinary amateur but particularly to market gardeners desirous of producing fresh vegetables for the market.

The importance of fresh vegetables for human consumption is becoming increasingly recognized since it has been found that their vitamin content rapidly diminishes on keeping. It is clear therefore that market gardens should be established in the vicinity of every community and for that purpose a ready supply of inoffensive and at the same time cheap humus is available from the much despised sludge or "slimy deposit" after this has been treated by modern scientific methods. —(*Gilbert J. Fowler, D. Sc. "The Gardener" Vol. II. No. 3*)

CO-OPERATIVE SUPPLY OF MUNICIPAL REFUSE AS MANURE

The Madura Sales Society ventured to take up the Municipal contract for the disposal of night-soil and rubbish.

Prior to this the right to remove these used to be sold by auction. Rich contractors as middlemen offered to purchase and made huge profits by selling to contractors at high rate. The ultimate price for cash was Rs. 2-4-0 per cartload of night-soil and 0-12-0 per cartload of rubbish. If on credit 0-1-0 per rupee per month as interest was also charged.

The people had already realized the use of nightsoil.

The obiect of the Society has been to sell to the small cultivator at as cheap a rate as possible. The society got the contract for Rs. 25,000/- for 1937-38. The cultivator is now able to obtain nightsoil at Rs. 1-12-0 per cart—load and rubbish at 0-7-0 per cartload. Along with reducing the price the Society has also been showing ways of compost making from night-soil and rubbish with a view to supplying the manure in the least dangerous and offensive form. For this purpose it tried the Indore Process which consists of :—

1. A shallow trench is made. 2. Alternate layers of rubbish and night-soil are spread. There are 3 layers of nightsoil in 4 of rubbish. 3. Mixture turned first after two days after the charging. 4. Then after eight days. 5. Then after 15 days. 6. Allowed to stand for 3 or 4 weeks after which it is ready for use. At the time of turning if the stuff is very dry water is sprayed.

The society started with using two cart-loads of rubbish for one cartload of nightsoil. The compost obtained was excellent. But it became costly—Rs. 2/8/- per cartload, while farmyard manure was selling at Re. 1/4/-.

To reduce cost, on the advise of the Agricultural Chemist, the ratio of rubbish has been increased to 4 cartloads for one of nightsoil. These are heaped to save cost of trenching. The cost has come to Re. 1/4/- per cartload. This manure has been tried by the ryots and found to be as good as the other manure.—(*The Madras Journal of Co-operation, Volume XXX. No. 1 July 1938.*)

POWER ALCOHOL FROM MOLASSES

Power alcohol instead of liquor" has for some time been the slogan of the Bombay Government. It has now been decided to utilise the molasses from all the eight sugar factories in the Presidency for the production of fuel. From the two sources a by no means negligiable quantity of power spirit should be forthcoming.

The question before Government, however and the reason that no progress has so far been made towards making a start with manufacturing this alcohol, is how to go about the establishment of the necessary factories. Should the work be undertaken by a department of Government in the same way as liquor is destilled now at Nasik or should the whole project be handed over to a firm already in the power spirit business, with full knowledge of the very latest methods of manufacture and at the same time with the means at hand of marketing the product to the best advantage of Government? Negotiations are now going on in regard to this point.

An impetus has been given to the scheme by the experience of the Minister for Public Works, the Hon. Mr. Nurie, in Hyderabad State last week. All preparations have been made there for the manufacture of power spirit from molasses on a large scale. It is estimated that 1,800,000 gallons can be produced from the present outturn of molasses in that State. Experiments have been carried out with the spirit produced and cars have been found to run on it as well as on imported petrol. It is proposed, however, to mix the power alcohol with petrol in the proportion of one to three, the total of which would meet the requirements of the State.

Apart from the incalculable value of making the province of Bombay at least partially independent of outside supplies of power spirit the scheme for the manufacture of that spirit has the added attraction of great profit for Government. In Hyderabad, it is estimated that power alcohol costs about three and a half annas to produce, which would mean that after allowing for distribution costs, profit to the manufacturers and so on, the State would be in a position to collect at least six and a half annas per gallon excise duty on the locally manufactured spirit. The same would apply in this province, and a new and increasing source of income for road construction would be available. It is believed that the present revenue on imported petrol would not be affected, the new spirit being absorbed by the annually increased demand.—(*The Hindu.*)

BOVINE COMFORT

Whether scientific advancement has proved to be an unmixed blessing to humanity or not, it does appear to be doing a world of good at least so far as the bovine world is concerned. There was first, the account from Australia some time ago of a cowshed fitted with a loudspeaker and the inmates being milked to music. Next one heard of cows going about in shoes as a safety measure against foot-disease. And now news comes from the Soviet that cows are wearing false teeth in Voroshilovgrad district.

According to the Moscow newspaper, *Vechernaya Moskva*, cattle on collective farms have been suffering from a mysterious disease which causes their teeth to drop out. The vets having failed to diagnose the trouble, one of the farmers, in desperation, decided to furnish every cow that had lost its teeth with a set of "masticators"; and these are claimed to function as well as the animal's original teeth.

At this rate the world might shortly hear of myopic cows grazing through pairs of spectacles and their crippled sisters hopping about on artificial rubber legs.—(*Times of India*).

Departmental, College and Hostel News

It gives us very great pleasure to accord our heartiest congratulations to. J. C. Macdougall, Esquire M. A., B. Sc., on his confirmation as the Director of Agriculture C. P. and Berar and to E. A. H. Churchill, Esquire B. Sc., on his confirmation as the Principal, College of Agriculture.

The College is now surfeited with the examination atmosphere, as the dates of the annual examinations are fast approaching. Every one appears to be very serious about his studies and the Social activities of the College are now practically on the wane.

We had amongst us Rao Bahadur Ramaswamy Sivan, Late Principal, College of Agriculture, Coimbatore, who was kind enough to give us an after dinner talk about his favourite subject of agricultural colonization. He gave an account of the colonization scheme which is being worked out in the Punjab. His talk was highly interesting and illuminating as his masterful way of speaking, was now combined with the showing of photographs of the colonizers houses, farms, cattle, etc.

As regards sports, we seem to be rather unfortunate this year; for, our Volley-ball Team, which was the holder of the "Robertson Medical School Volley-ball Tournament Cup" and which was strongly fancied for the final honours this year as well, won the first two rounds in fine style, but as ill luck would have it, lost by a narrow margin in the finals. However, we had put up our best performance, and the match was certainly worth the play. Our players need not, in any way get disappointed at such reversals, and we are sure they will start with renewed vigour in the next session.

The Final match of the College Tournment in Tennis Singles was played on the morning of 2nd Feb. 1939 between Messrs. H. N. Dass (IV year) and B. B. Bannerjee (II year) when Mr. and Mrs. Churchill kindly graced the occasion by their presence. The match proved to be a very interesting event as the spectators were all the time under a state of pleasant suspense, when the fluctuating fortunes of both the sides hung up the result in balance. Each point had to be won, after a protracted rally, full of occasional flashes of spectacular drives. The trophy went to the youngster who no doubt gave an excellent account of himself characterized by great patience, while the elder player who has an inimitable style often gave us thrilling tennis specially at his occasional net incursions.

Our thanks are due to Mrs. Churchill who kindly agreed to present a cup to the winner and to give away the trophies and to Mr. Churchill without whose encouragement in matters of sports such activities of the College would not have been a success.

We are glad to note that Mr. N. B. Gupta of the IV year has been selected by the Nagpur University in it's Hockey team.

LEAVE

Name of Officer.	Designation.	Period.
K. G. Paturkar	Farm Supt., Yeotmal.	1 month and 10 days from 21st Oct. 38.
R. N. Keyasth	E. A. D., Drug.	4 months from 17th Jan. 39.

Cow Anusuiya of the College Dairy with her twin male Calves.

मेरे बक्खर के बैल, सखे !

आओ बातें करें आज हम, कब तक मैं चुपचाप रहूंगा ।
कोई सुने न, तुम तो सुन लो, आज कहानी तुम्हें कहूंगा ॥
मैं उत्तम, विद्वान, चतुर, सुन पड़ जाता सब दिल में धड़का ।
इतने पर भी कहलाता हूं मैं 'बक्खर कालेज' का लड़का ॥
'बाबू' मुझे न कहता जग, कैसा किस्मत का खेल सखे ?
जीवन के संगी साथी, मेरे बक्खर के बैल सखे ।

हरी घास चर ले छककर तू, हरी चरी चर ले रे दाना ।
अभी दौडकर आता हूं मैं, खाकर, सखे, 'मेस' का खाना ॥
पूरा करना टॉच 'वर्क' खेतों पर, पर तू मत थक जाना ।
तेरी 'ड्यूटी' है जुतना, मेरी है बक्खर आजचलाना ॥
चलो, बढ़ो, दौड़ो, भागो, जैसी दौड़ेरे रेल, सखे !
जीवन के संगी साथी, मेरे बक्खर के बैल सखे !!

कोई जाते, दौरा करते, कोई रेल-मेल पर आते ।
सरकारी क्रमशः विभाग में, 'आनर' और तरक्की पाते ॥
कोई साहब सिविल बने, सड़कों पर हैं मोटर दौड़ाते ।
कोई लम्बी छुट्टी लेकर, शिमला और विलायत जाते ॥
पर अपने विभाग का कोई अजब तरीका खेल सखे !
जीवन के संगी साथी, मेरे बक्खर के बैल सखे !!

हो जाता संतोष मुझे, औ हो जाती मेरी तबियत तर ।
अपने संग के भी लखता हूं, जब कुछ छोटे मोटे अफ़सर ॥
'चर्चिल', 'फाटक', 'नायर', 'अय्यर', 'वैद्य', 'द्विवेदी' औ, 'जोगलेकर', ।
'राव', 'रहीम', 'भाटिया', 'दत्ता', 'राने', 'जोशी', 'डिघे', 'कलमकर' ॥
'साहब धन्नालाल', 'बाल', 'मिश्रों' का सुंदर मेल, सखे !
जीवन के संगी साथी, मेरे बक्खर के बैल सखे !!

वे अपना उपहास करें यदि, जो बी. ए. बैठे ठाले हैं ।
सुनना मत, बढ़ते ही चलना, हम 'बक्खर कालेज' वाले हैं ॥
जो कुछ थोड़ा मिले मित्र !, उतने में ही संतोष मनालें ।
थोड़े में जीवन को सम्पूर्ण रूप से सरस बनालें ॥
धरती मां की सेवा कर बदलें 'हेवन' में 'हेल' सखे !
जीवन के संगी-साथी, मेरे बक्खर के बैल सखे !!

रामकृष्ण शुक्ल
तृतीय-वर्ष
बी. एस. सी. (एग्री.)

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Editorial

DRYING TENDER GRASS

One of the ways of improving the yield and quality of grass obtained is by cutting the grass frequently when it is tender. We remember to have read sometime back in one of the local news papers, a suggestion made from some one in Berar that as lot of valuable grass is wasted in the jungles during the rains that drying the grass by artificial means should be tried. For drying tender grass with the object of improving the yield, quality, and overcoming the unfavourable weather conditions on the field which do not permit open or sun drying, machines have been invented in which the tender herbage can be dried by heat and air. The dried tender grass can be easily stored and transported.

It is acknowledged by all who have tried this dried tender grass as a diet for cattle that it is a rich food and sometimes as valuable as the lower grades of concentrated feeds. It is even considered as body building food and a food which supplies energy quickly even for human beings. We are informed that in a certain State in the United States the members of the University Basket Ball Team are made to eat daily a dose of grass of the above description to keep themselves fit and that certain companies are selling dried grass in the form of patented products as health giving tonics. There are grass guzzolers who

are quite impressed with the health giving properties of dried grass and take a spoon full every day to overcome the depressing effects of winter. It is commonly observed that cattle improve in condition when young grass in available in the pasture. Evidently there must be something in the young grass which makes it so healthy and nutritious. It has also been found out recently that if the grass is kept short by frequent cutting the grass retains its high feeding value. Tender grass when cut and dried immediately retains it's health giving properties. The grass can be cut once a month. Dehydrated grass differs from hay in that dried grass is only fresh grass with the water taken out. But in the case of hay many valuable nutrients including vitamin A, are removed due to prolonged drying in the field.

Dehydrated grass has also been found capable of imparting to the milk a beautiful yellow colour because of the carotene in the grass. Dried grass when fed to poultry increased the hatchability. Chickens are raised statisfactorily quite in doors with the food.

The technique of drying the grass consists of two ways (1) using a hot current of air at a high temperature (800 C to 1500 C) but only for a short time (2) using only a temperature of (150 C) but keeping the grass in contact with the air for longer periods. The grass never reaches the high temperature so long as there is moisture in the grass for the heat is also used in evaporating it. The main object is to get unscorched, even dried product which will be palatable and as valuable as green grass.

Grass drying machines were first ready for practical tests under field conditions in 1933 in England. But till 1935 the general farming public were not really interested in the recent innovation of grass drying. If grass could be dried artificially the land could be cut several times during the season despite the bad weather and every field could contribute it's full share to the farm. It is a kind of factory process applied to agriculture. A few English farmers who during the last three years tried grass

drying have kindly given out the financial aspect of their experiences. Two or three of them with the right kind of machine were able to get their costs below £ 5 a ton, excluding management, farm overheads, and storage charges; but the general average appears to be near £ 6 a ton. But one thing that should be borne in mind is that the stuff obtained is not hay, but a highly concentrated food which can displace many such feeds as bran, cakes etc.

One of the machines tried by the pioneer farmers was the Curtis Hatherop machine. It produces 500 to 800 lbs dry grass per hour. The cost of drying worked out at about £ 5 per ton of dry grass obtained.

Grass means not more than 6 inches long and drying means the extraction by artificial means of sufficient moisture, say upto 80 per cent, to enable the residue to be conserved for use as food.

Dry grass does not contain more than 13 to 20 per cent protein and hence with reference to this food ingredient it is inferior to cakes which contain over 22 per cent. But it is more to be valued on account of the carotene which gives the milk the rich yellow colour and possibly a higher vitamin and mineral content than cake.

Even among the dairy men who have tried grass drying to save cake merchant's bills opinion is divided. Some talk enthusiastically about dry grass, and its carotene, vitamin and minerel ingredient. While others belive that cake beats dry grass and that caroten, vitamin and minerals may be supplied by feeding Carrots, Kale, or Silage at a lower cost.

No matter what type of drier is used the total cost of installation for a machine to give an output of 300 lbs. dry grass per hour will not be less than £ 700.

The grass drier may be useful in dealing with tender grass when it is growing in plenty, or to fight with wet weather which

makes hay-making difficult. But the grass drier will not make grass grow during a drought and will have to be lying idle. In India the usefulness of a grass drier offers scope for trial since much of the grass growing in the jungles goes to waste.

Drying of forage crops other than grasses like clover is being attempted in England.

Original Articles

A NOTE ON THE EFFECT OF AMOUNT OF FEEDING OF SUGARCANE IN THE MILLS ON THE EXTRACTION OF JUICE

By R. J. Kalamkar, B. Ag., B. Sc., Ph. D.
(Deputy Director of Agriculture, Jubbulpore.)

AND

W. S. Dehadrai, B. Ag.
(Agricultural Overseer, Exptl. Farm, Adhartal.)

1. **Material and method.**—This preliminary note briefly describes the effect of feeding of varying number of sugarcane on the amount of juice extracted and the time required for it. The experiment consisted of feeding Co. 237 sugarcane in lots of 3, 4, 5 and 6 in 3 rollered Sultan Mills, two of which had 8.5″ diameter and height while the third had 7.25″ diameter and height. Setting of the Mills was normal. 100 lbs. of sugarcane were used in each case. The number of canes, the amount of juice and time required in each case were recorded. The speed of the bullocks was normal throughout the experiment. The results are tabulated below in Table 1. The data are statistically examined.

TABLE 1

	Mill 1				Mill 2				Mill 3			
	Number of canes fed at a time.											
	3	4	5	6	3	4	5	6	3	4	5	6
Number of canes,	72	82	85	95	71	78	75	91	73	84	75	88
Wt. of juice in lbs.	64.5	66.5	65.5	64.5	62.5	64.5	65	65.5	65	65	67.5	67.5
Time in minutes.	36	26	23	20	30	29	19	18	29	25	23	17

2. **Variability in the number of canes per 100 lbs. of sugarcane.**—The mean number of canes per 100 lbs. of sugarcane is 80·75 with a standard deviation of 9.85 per cent. No observations on the length of millable cane and its diameter were taken.

3. **Effect of feeding of canes in different lots on the extraction of juice.**—The analysis of variance of amount of juice extracted is given in Table 2,

TABLE 2

Analysis of variance of extraction of juice.

Due to	D. F.	Sum of squrs.	Mean squr.	F.	F. for significance at 5% level.	Remarks.
Feeding ...	3	7.42	2.44	2.16	4.76	Not significant.
Mills ...	2	7.04	3.52	3.11	5.14	do.
Error ...	6	6.77	1.13			
Total ...	11	21.23	1.93			

The data indicate that there is no significant difference in the amount of juice extracted both for the canes fed in different lots and for the different mills used.

Mean values are tabulated below.

TABLE 3

Juice extraction for different lots of cane fed.

No. of canes fed	3	4	5	6	Mean.	S. E.	S. E. %
Juice in lbs.	64.0	65.3	66.0	65.3	65.3	0.61	0.93

TABLE 4

Juice extraction per Mill

No. of Mill.	Mill 1	Mill 2	Mill 3	Mean	S. E.	S. E. %
Juice in lbs.	65.3	64.4	66.3	65.3	0.53	0.81

From table 3 it appears that although no significant variation of juice extraction is noticed compared to the general mean there are indications that canes when fed in lots of 3 gave lesser juice extraction compared to higher feedings. It is possible to test if the juice extraction in case of feeding 3 canes is significantly different from the mean extraction of juice when the canes fed 4, 5, or 6 at a time are taken together. Analysis further carried out shows that out of the 7.42 sum of squares with 3 degrees of freedom for feeding of canes, 6.25 alone represents that due to difference between the juice extraction when canes are fed in lots of three and the mean juice extraction for canes fed in lots of four, five and six viz, 64.0 and 65.7. The ratio of 6.25 to 1.13 works out to 5.53 while for significance it should be 5.99 for one degree of freedom against six. The difference is not still significant although it is approaching the 5% level, in view of the small number of degrees of freedom on which the error is based.

Similar analysis of juice extraction for Mill No. 2 against the mean juice extraction of Mills 1 and 2 together shows that out of 7.04 sum of squares with 2 D. F., 1 D. F. due to the above contributes 4.59 sum of squares which is not significant compared to the error variance. It thus shows that although Mill No. 2 has given lesser extraction compared to the other two the difference is not statistically significant.

4. **Variations in time for crushing canes in different lots on different mills.** The analysis of variance for the time required for crushing 100 lbs. of canes in different lots is given below.

TABLE 5

Analysis of variance

Due to	D. F.	Sum of sqrs.	Mean sqrs.	F.	F for 5% significance.	Remarks.
Feeding ...	3	306.25	102.08	17.24	4.76	Significant.
Mills ...	2	17.17	8.59	1.45	5.14	Not significant.
Error ...	6	35.50	5.92	...	...	...
Total ...	11	358.92	...	...	...	...

The variation in time due to feeding of canes in different lots is at once significant. The variation in time taken by the different mills is not significant. The mean values are tabulated below.

TABLE 6

Time required in minutes for juice extraction of 100 lbs. cane for different lots of canes fed.

No. of canes fed	3	4	5	6	Mean.	S. E.	S. E. %
Time in minutes	32	27	22	18	24.6	1.4	5.7

TABLE 7

Time required in minutes for juice extraction of 100 lbs. of cane for different mills.

No. of mill	1	2	3	Mean.	S. E.	S. E. %
Time in minutes	26.3	24.0	23.5	24.6	1.22	4.95

5. **Summary and conclusions.**—(1) Mean number of canes per 100 lbs. of Co. 237 sugarcane was 80.75 with a standard deviation of 9.86%.

(2) Feeding of canes in lots of three at a time appears to yield lesser juice extraction compared to the feeding of canes in lots of 4, 5 or 6. The difference is, however, not statistically significant.

(3) There is a significant variation in time for crushing canes in lots of 3, 4, 5 or 6 fed at a time, the time required being in a descending order, 32 minutes being required to crush 100 lbs. of cane in lots of 3 and only 18 minutes when fed in lots of 6.

(4) No significant variation in the extraction of juice or in the time required was noticeable for the three mills used in the experiment, although Mill No. 2 gave lesser extraction of juice and Mill No. 1 required more time.

(5) Mean extraction of juice per 100 lbs. of cane was 65.3.

THE IMPORTANCE OF HEREDITY AS A FACTOR IN "CROP IMPROVEMENT"

By S. B. Vaidya, B. Ag.
(*Lecturer in Botony.*)

To begin, we ask what is meant by heredity ? Concisely stated we may say it is the transmission of life from one individual or pair of individuals to a third. Another definition is that heredity is likeness or resemblance of offspring to parents. In either statement there is the implication that life is passed on from one generation to another and that the offspring partake of the qualities or characteristics of their parents. In fact when we consider the matter even a little we observe that the likenesses are the outstanding feature. The offspring of cattle are never sheep, nor is the progeny of wheat ever barley, though some people may so imagine. The progeny of cattle are cattle only, and of wheat, wheat only. The resemblance which offspring bear to parents is such that the species or type, be it plant or animal, to which both belong are unmistakable.

So far so good, but what are resemblances and how are they transmitted ? This is the question we must ask and answer if we are to understand the hereditary process. A corn plant resembles another in that both have stalk, leaves, ears tassels and are readily identifiable as corn. These likenesses are real but between two corn plants very great differences may exist. On one the stalk may be tall, its leaves broad, its ears large with kernels flint or dent, starchy or sweet, and in colour white, red, yellow or variegated. It may require as many as 200 days of growing weather to mature seed. On the other hand, another corn plant may be short of stalk, its leaves narrow, its ears small, and its period of growth to maturity less than 100 days. These differences between the two types are character differences and are characters that are definitely inherited. It is with differences of this kind that the breeder is concerned and the study of these has contributed to our knowledge of the transmission of characters and has shown us how the hereditary machine works.

We will recall an earlier statement to the effect that Gregor Mendel made a very significant contribution to the study of heredity and to the allied art of breeding. His real contribution was that he showed for the first time that certain characters are transmitted as definite unitary things. He crossed a wrinkled pea with a smooth one. Later on he was able to get back pure wrinkled and pure smooth peas from the cross and in definite numbers. He showd by this that there was some definite material factor in the pollen or egg cell of the plants which gave rise to

wrinkledness or smoothness and that these could be combined in the cross and later separated out without any blending or contamination of one with the other. Here was a key which would unlock many of the mysteries of inhertance. It likewise furnished the breeder with a most useful idea in carrying on his work. Suppose the plant breeder had a yellow kernelled sweet corn which was in all respects similar to the one he has except that he desired the new corn to be white in kernel colour, he could obtain the new type by crossing his yellow sweet corn with any white variety he might have made. In the crop grown the second year he would select only sweet white seeds from the ears for planting. The crop grown from these would be white and sweet only. Probably other differences would enter in, such as differences in maturity, size and shape of ear, and the like and to remedy this further selection would be necessary. The point, however, is that the characters with which he is primarily concerned, namely, colour and texture of kernel, are things which are inherited as definite and distinguishable things that in the pollen and egg cells of the plant there are bits of matter which account for these characters and give rise to them; that these bits of matter don't fuse or blend or disappear. They hold their own identity and go into the crosses and come out again without any loss or change.

The importance of this discovery was very great because it enabled the breeder to plan his work with a definiteness which he could not do before. But it also showed him that he must (in order to be successful) rightly distinguish beforehand whether the differences with which he was dealing were actually inheritable or whether they were due to the environment in which the plant grew.

It was formerly a common belief that the conditions under which plants grew affected hereditary characters. People thought that plants were changed by culture, and that plants were able to adapt themselves to new conditions. If, for example, a variety of, let us say wheat, was brought into a section where it had not been grown before and if it failed to do well it was said to lack acclimatization. It was supposed that if it were grown for some years in its new habitat this defect could be overcome and the variety would do better and, as they said, become acclimated.

The only objection to this view of heredity is that it is not true. The hereditary units or particles which give rise to characters are not changed by environment. They remain constant. Acclimatization, as it is called, can occur only in some crops where there are present

some plants which are already acclimated and which because of their greater seed production gradually displace in succeeding years those types which are unadapted. This is the case with self pollinated crops like oats, beans, wheat, barley and the like. In other crops, such as corn, rye, timothy and some others, where cross pollination is the rule, acclimatization or adaptation comes about through selection of new combinations of the hereditary practicles or determiners. The point I wish to make clear is that environment is of no effect in bringing about any actual changes in the hereditary materials themselves. The genes or factors which determine plant characters are stable and for all practical purposes remain unchanged and unchangeable. What actually does happen is that new combinations of these practicles are possible, due to cross pollination and in consequence some plants appear which are better adapted to the environment and produce more and better seed than others do. Selection of these is effective and a so-called adapted strain results. The important thing to remember here is that getting the right heredity for the growth conditions provided is the all important matter. Good adaptation simply means that plants having it have such an hereditary make up that they can and do respond well under the growth conditions provided.

Let us take an illustration from each of the two great types of field crops. Commonly we group plants in two classes those which are generally self or close pollinated and those which habitually cross fertilize Field or garden beans are an example of the self pollinated group. Now everyone who has grown beans knows that sometimes a disease gets in and ruins the crop. Such a common disease is the black pod spot which may ruin a whole field in a week. There are different strains or varieties of pod spot, three of them in fact. some varieties of beans are resistant to one are or two of those forms of pod spot and susceptible to the third. Other beans are resistant or susceptible to others of the three forms. The old New York pea bean was apparently susceptible and never became adapted or acclimated to the extent that it could resist pod spot and some other diseases, such as the dry root rot. It therefore passed out of the picture and is a relic of the past. It lacked the definite hereditary factors of disease resistance and could not acquire them. It could not successfully acclimate itself to an environment where pot spot and root rot where present. What was the result? A new pea bean took its place. Why, because of better yield? No. Of better quality? No. The new been supplanted it because it had in its heredity some factors for resistance to these diseases which the earlier bean lacked and which it never could acquire.

Now the new bean that took its place—the Michigan Robust, as it is called is unfortunately susceptible to one of the three strains of pod spot. There is no evidence that it has acquired any immunity to the disease even in the fifteen years it has been grown in the State. But by crossing it with Well's Red Kidney,. which is immune to the particular strain of pod spot to which the Robust is susceptible, a new pea bean has been develeped which is resistant to all known strains of the disease. In time this will probably replace Robust. Varieties come and go. But they come because they have a hereditary make up which suits them better to their environment than the heredity of the sorts they displace. They "go" in turn, as some weakness which is part of their inheritance is discovered and a still more effective heredity is found to take their place. Environment changes and plant heredity must be altered to meet the changed conditions. Such alteration can occur only through some sort of breeding process.

If we look at the broblem of adaptation in the case of the cross-pollinated crops, the importance of heredity is equally apparent. Here because of constant crossing and the fact that in most cases highly hybrid plants are more vigorous than are inbred individuals of the same crop, new combinations of hereditary characters are constantly occurring. If these are better adapted to the farmer's, purpose than are others, they are selected and gradually a new race or variety is built up which becomes more and more adapted as selection proceeds. The case of corn is an excellent example. The variety Cornell 11 was derived by this sort of selection from Pride of the North. Yet there are several strains of Cornell 11 that ripen well even in the immediate neighbourhood of Ithaca where its parent variety, Pride of the north, rarely does more than reach roasting ear stage. How has it been possible to bring this about ? The procedure of course was to select seed from early maturing plants year after year. What really happened was that hereditary determiners (or genes, as we call them), for early maturity were present. These factors were just as definite as the factor which gave rise to the smooth or wrinkled condition in Mendel's peas—but there were more of them. Breeding, that is to say selection, isolated plants which had these factors for earliness in considerable numbers and when selection had gone far enough to fix them a new variety or strain was the result.

Acclimatization as it is commonly understood exists only in immaginitaon. But if looked upon as an actual breeding process whereby

nature or man picks out the best individuals or groups and multiplies them because they are more prolific of progeny or more suited to his needs, then the idea has meaning. Adopting this viewpoint, we see at once that plant heredity is and must be a matter of overwhemling importance in any kind of crop improvement where plant adaptation is a factor.

NON CREDIT CO-OPERATIVE SOCIETIES FOR AGRICULTURE

By J. L. Sen, B.Ag.

(Service of Credit Societies to Agriculture, Assam.)

In view of the present low standard of education among the masses, non credit societies do not promise immediate success. In the meantime the Agricultural Department should make use of Co-operative Credit Societies by making them instrumental in the dispersal of new ideas and the introduction of improved varieties. When loan is advanced by Co-operative societies or by the Government to finance such items of Agriculture as the purchase of seeds, implements etc, the debtor must agree to their purchase from a Government seed-depot or any recognised seed farmer or firm. This may in the beginning arouse some suspicion in the minds of cultivators but it will be dispelled when they will realise the merits of good seeds and improved implements. Long term-loan may be advanced to selected cultivators at least for 3 years if not for 5 years on the condition that during this period they will farm according to the directions, laid down by the District Officer of Agriculture in charge of the circle. A cultivator so doing will be guaranteed against any loss, arising from the impotency of the measures suggested. But the profit and loss statement should be drawn at the end of the whole period so that any loss incurred in a bad year may be more than made up in a good year. This imposes the condition that a cultivator must maintain an account, recording the receipts and expenditure which will also include his own labour wages. No guarantee can be provided for a loss from any unforeseen slump in the market.

Organisation of non credit societies for Agriculture.—Side by side with this sort of organisation of non agricultural societies, purely agricultural societies should be organised for the furtherance of agricultural production. These agricultural societies may take the following forms.

(1) Co-operative purchase and sale societies.
(2) Co-operative crop-protection societies.
(3) Co-operative Agricultural Associations.
(4) Co-operative milk societies.
(5) Co-operative sale-societies.
(6) Co-operative production societies.
(7) Co-operative Livestock Improvement Associations.
(8) Co-operative cattle insurance societies.

Co-operative purchase and sale societies.—Ordinarily the purchases and sales made in a village may not be sufficiently huge or continuous to necessitate the organisation of a Co-operative purchase sale society. But the domestic and agricultural requirements of a pargana or taluk may ensure its success. Every such society must have a stall of seeds, manures, agricultural appliances and domestic reqirements. This will secure the benefit of Co-operative purchase to cultivators. The necessary fund may be raised by share capital, and loan from the Government. The profit made by collective purchase should be distributed among share-holders in proportion to their individual purchases after setting apart a certain percentage as Reserve Fund. The function of Co-operative sale also could be undertaken by a society, which should pool the agricultural produces for sale and sell them direct to whole-sale dealers. This will secure the lion's share consumed by middlemen to cultivators.

Co-operative crop protection societies.—Though full-fledged Co-operative societies for Co-operative protection are non-existent, still Co-operative efforts in such matter as protection of crops from stray cattle are common everywhere. But such efforts are limited only to Co-operative grazing, which does not require any fund. The protection of crops from pigs, water-hyacinth, insect pests also requires organised Co-operative efforts and necessary fund which can be raised in the manner described above. The need for Co-operative crop protection can not be over-emphasized. In the absence of any such effort regular cultivation of Rabi Crops is almost non-existent. Thus self-subsistent farming, which we are trying to introduce has become a remote possibility. Often we find one or two enterprising cultivators, ready to grow pulses, spices, or oil seeds but their attempts are chilled by their apathetic neighbours who often deliberately subject these crops to cattle depredation. The protection of crops from water-hyacinth cannot be achieved until organised Co-operative efforts are put to it. Similarly the menace of insect pests cannot be tackled properly without the concerted action of cultivators.

Co-operative milk societies.—The organisation of Co-operative Milk Societies by the department has proved a failure. Among many contributory factors, the apathy and indifference of members can be cited as the most glaring one. The organisation owes its origin to Government initiative and not to spontaneous action taken by milkmen themselves who often regard a society as a customer of their milk. To ensure success, the interest of subscribing members must be created first and the effort and initiative must come from them and not from the official stream.

Co-operative Agricultural Associations.—Everything concerning the economic interest of the members excepting the supply of credit should come within the activities of an Agricultural Association. Propaganda for the improvement of Agriculture, the purchase of agricultural and domestic requirements, hiring out of implements and machines, marketing of agricultural produce etc., should be undertaken by it. An association must train one of its members in agriculture on improved lines in a Goverment farm or recognised agricultural institution and utilize his services for the betterment of the existing agricultural practices.

The membership to any registered Co-operative society in a town or village must be open to all agriculturists above 18 years of age and of good character. The necessary fund must be raised by share capital.

The management of an association must rest on the hands of a Managing Committee, duly formed. To avoid complications, credit transactions should be avoided. The member must have a prior claim to the privileges furnished by an association even to the detriment of its economic interest as co-operation is an association of individuals and not of capital. Twenty five per cent of the net profit, secured by an association must go to form the Reserve Fund and the balance must be utilized for the following purposes. (1) Creation of a bad debt fund. (2) Payment on paidup share capital as dividends. (3) Payment of of rebate to members in proportion to the amount of purchase made by them during the year. Such an association can utilize the services of the district staff of Agricultural and Co-operative departments more than individual members can themselves do. To help these departments in rendering their services, associations must submit jointly their reports quarterly, pointing out their short comings, to the Director of Agriculture and Registrar of Co-operative Societies. Such an association will be a nice ground for the propagation of ideas of different nation-building departments namely Agricultural, Educational, Sanitary Etc.

Co-operative sale societies.—It is a well known fact that a market is the safety value of production and supplies the driving force for better production. It has been rightly remarked by the Royal Commission on Agriculture in India that "The importance of such markets lies not only in the functions they fulfil but also in their reactions upon productions. Well regulated markets create in the mind of the cultivator a feeling of confidence and of receiving fair play and this is the mood in which he is most ready to accept new ideas and to strive to improve his agricultural practice. Unless the cultivator can be certain of securing the adequate value for the quality and purity of his produce, the effort required for an improvement in these will not be forth-coming." Our daily experience also corroborates this statement fully. The extreme apathy of cultivators to better farming, to result in better production is due to the absence of well regulated markets to stimulate them. Similarly our efforts to introduce better varieties are not very warmly responded to; as no premium is paid for the quality in local markets where most of the agricultural produce of a cultivator is disposed of. Further the present system of marketing by individuals does not enable a cultivator to present a sufficient bulk in proper grade to be in direct touch with the export market and to minimise the spread between producers and consumers prices. Thus when viewed from all corners, the importance of organising Co-operative sale societies needs no emphasis.

The great disadvantage which forces a cultivator to unload his produce in an otherwise favourable market is the want of (1) cash at the time of harvest (2) facilities for proper preservation and (3) suitable transport facility all throughout the year. All these factors largely account for the great disparity in prices at the times of harvest and sowing. Co-operative marketing presupposes the removal of these disabilities and needs the organised efforts of different departments. The improvement of transport facility is a subject which concerns public works department, local boards village authorities and Panchayats and needs their concerted actions. The devising of suitable measures for preservation comes within the preview of our department. Financing at the time of harvest must be taken up by the Government.

All the produce of the same class should be pooled together in a pool, organised by the co-operative sale society. A cultivator on the production of his produce to the pool, must get half the anticipated price. This will enable him to meet his immediate requirement for cash. The balance due must be paid on the sale of the produce after deducting the expenses

of marketing and a small profit to be distributed among the producers as dividends and also a percentage of the net profit to be kept for Reserve Fund. This sort of pooling and selling in bulk will enable the producers to grade their commodity properly and to secure a better price for it.

Co-operative production societies.—The evils of small and fragmented holdings are too numerous to describe in detail. A small holding cannot give full employment to a cultivator's bullocks, implements and his labour and leads to enforced idleness. The introduction of power-machinary is not profitable there. Any measure that increases the agricultural production cannot be introduced unless cultivators are ready to sink their individual interests in collective interest. In a Co-operative production society, a body of cultivators has to pool their resources and put them to the benefit of all.

The collective farming, thus sponsored, must be financed by cultivators in proportion to the area of their arable land. A Co-operative Production Society may also borrow from a Co-operative Credit Society and from the Government. It must engage an accountant who will maintain an account of the expenses (including the labour wages of the members), incurred in collective farming. A portion of the profit must form a Reserve Fund as an insurance against a bad year and the rest should be distributed among the members in proportion to the land labour and capital, furnished by them.

Co-operative Livestock Improvement Associations.—The collective effort in Livestock Improvement is indispensable. Breeding, feeding Etc demand the organised effort of a number of farmers. The jurisdiction of a Livestock Improvement Association must extend over a Taluk or a Pargana. An association must maintain its own stud bulls and cultivate its fooder. In this district the scarcity of sufficient green and nutritious fodder is very acute in some parts of the year and the effort of an individual farmer can not reach the threshold of the problem. If the cultivators are all improved with the idea of growing fodder, the fodder supply can not be problematic. A Co-operative Livestock Improvement Association can secure its cattle life against epidemic diseases by providing proper preventive and curative measures. An association can start a dairy as its offshoot and can handle milk more profitably than an individual farmer can do.

Co-operative cattle insurance societies.—The attempt of insuring cattle against mortality has proved a failure in India due to extreme precariousness of cattle life. An insurance policy can cover only the ordinary risk,

of life and not the risks incidental to epidemic diseases. With the extension of the activities of the veterinary department and rousing of public opinion in regard to the appalling wastage of cattle-life as victims to epidemic diseases, cattle insurance will gain in popularity.

Conclusion.—I have discussed the organisation of such societies as should draw our immediate attention. Other types of societies will grow once co-operation has established itself into our social substratum.

A charge is often put forward that Agricultural Department has failed to do anything for the cultivator. No doubt it is largely due to short sightedness of the observers and their inability to grasp the true nature of growth and improvement, which are conspicuously slow, still there can be no denying of the fact that we are still far below the standard, aimed at. The absence of co-operation and education among cultivating classes is retarding our progress and often no headway can be made. No improvement—be it agricultural, educational or sanitary can be ushered into existence unless co-operation comes to our aid. Indeed co-operation is a great panacea for all our maladies—social, political or religious and rural prosperity and welfare largely depend upon the resuscitiation of co-operation among the villagers. It has been very aptly remarked by the Royal Commission on Agriculture in India "If co-operation fails, there will fail the best hope for rural India."

THE DEPARTMENTAL EXHIBITION HELD ON THE 26TH FEBRUARY 1939 AT NAGPUR.

By K. S. Krishna Rao

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The Department of Agriculture held an exhibition on the 26th February at Nagpur in order to help the neighbouring cultivators and malguzars of the province in knowing some improvements in the different practices prevalent at present. The improvements suggested were quite simple, yet effective and within the means of the average cultivator.

The exhibition was held on the Nagpur Experimental Farm between 8 and 11 a.m. It was divided into a number of suitable sections such that each visitor could easliy find the section he was most interested in and obtain the necessary information in detail.

The first section which any visitor would come upon was the Poultry Section arranged by the Poultry Section of the Telenkheri

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Dairy. Here one would find all that was recommended to the cultivator to make his poultry keeping more profitable than it is at present.

First of all came the importance of keeping a Foster Mother. Success in brooding operations depends on how well they are brooded. The model exhibited in the section was a small wooden box covered on all sides and provided with a small door. The top was made converging into a chimney, below which was kept an ordinary lantern to supply the heat. The base of the box was covered with some litter like hay. This arrangement would maintain the temperature of the whole box at 104° F just as the hen does. This apparatus provides as much comfort and efficiency as the real mother.

The next thing of interest was egg-testing and the apparatus with which it is done. This is done by using a specially made balance like the one on which the weight of an envelope is obtained directly. The other apparatus used is a lamp which sends a beam of light into a concavity in which the eggs to be tested in placed. The translucency of the egg indicates the developing embryo inside and the tester can know whether the egg in question is a fertile one or an infertile one or an addled one. The following are the indications which help the egg-tester in judging the quality of the eggs :—

1. **On the 7th day.**—Evenly clear light through large air-space bigger than usual indicates an infertile egg.

2. Distinct pea-size dark spot at top end of the egg from which radiate bloodlines and move; immovable air-space larger than normal indicates a strongly fertile egg.

3. Confused movable mass dark in colour and floating about the egg indicates an addled egg.

1. **On the 14th day.**—Confused movable dark mass with air-space hazy indicates an addled egg.

These are the indications as seen through the lantern described above.

The visitors were also given the following advice as regards the production of good quality products :—

1. Gather eggs three or four times a day.
2. Hold them in a place which is cool and free from odours.
3. Never produce fertile eggs except for hatching.

4. Prevent dirty eggs by having clean nests and clean houses.
5. Feed properly.

The following were the instructions issued for feeding poultry :—

1. Furnish Oyster meal or lime to form strong egg-shells.
2. Avoid bad flavours caused by rape.
3. Cull out and sell hens producing poorly-shaped, thin-shelled and small eggs.

There was also another metallic incubator prepared at the Telenkheri Dairy Farm with was also kept for exhibition. Its capacity was a hundred eggs and it was estimated to cost about Rs. 75/-. It has got a double control in that it has one thermometer in the egg-tray and the other in the nursery-tray which helps in keeping the top and the bottom at proper temperature.

The main requisite of poulty-keeping being the housing of fowls, there was a simple and efficient house exhibited which could be made by any country carpenter. It cost only Rs. 25/- and it could accommodate 15 fowls. It had all the following advantages of a good poultry house. It protected the birds from rain and clouds at night and from the sun during the day. It was tick and vermin-proof along with its being easy to clean and disinfect. It also provided safety against wild animals while providing safety for laying. Above all it was easy and cheap in construction still being portable thus aiding sanitation. There were houses also exhibited in which there was accommodation for individual fowls as seen on the more expensive farms abroad. Many types of devices were exhibited which would automatically close after the fowl had got in.

Then came the exhibition of the different breeds of poultry that are at the Telenkheri Farm. There were the Welsummers, the Rhode Island Reds, Black Minorcas, the Leghorns the Light Sussex and the Astra-torps along with the local graded hens. Suggestions were also made to improve the local fowls by grade-breeding, whereby in the seventh generation the fowls produced are mostly pure with only a trace of the mongrel blood.

Lastly came the dream of India becoming an important producer of poultry due to its unique geographical position by the following means:—

(i) By starting poultry-clubs and associations.

(ii) Selective breeding of indigenous fowls and grading.

(iii) Organizing co-operative marketting.

Cattle management section.—This was the second section to which one's attention was drawn when he had just finished with the poultry. Here the demonstration started with the methods of skimming milk. The advantages and the disadvantages of the different systems were set out and finally the method recommended was that of practising Centrifugal Skimming. Nextly a picture of the Alfa-Laval magnetic milker was exhibited in order to show how much the science of Animal Husbandry is advanced abroad and how we must make haste to overtake them.

The importance of economical cows was indicated in the exhibition and to make this point drive home, statistics of two Home-bred cows from the Telenkheri cows were set forth as follows:—

Name of the Cow.	Radhia No. 8	Ketaki No. 5
Born on ...	29-1-25	26-6 1924.
Date of 1st calving ...	13-3-27	23-7-1927.
Production of milk till 29-5-1938	544 maunds	558 maunds.
RECEIPTS ...	Rs. 3,536/-	Rs. 3,630/4/-
EXPENSES		
Cost of rearing till 1st calving ...	Rs. 250/-	Rs. 300/-
Cost of feed ...	,, 1,680/-	,, 1,500/-
Labour ...	,, 165/-	,, 150/-
Over-head charges ...	,, 370/-	,, 330/-
INCOME	Rs. 1,071/-	Rs. 1,350/4/-

After this came the production of clean and safe milk. All the necessary instructions regarding the production of clean milk were set out and it was vividly brought to the notice of the visitor that he must practise great cleanliness if he wants ideal milk. As regards the choice of a good dairy animal the visitors were given to understand the usual characteristics of a good milch-cow. The main points are the possession of a dairy temperament, large deep barrel with a well-shapped and developed udder. The importance of having a big nose and a roomy chest was also emphasized.

Nextly the statistics of the milk consumption in different countries of the world were set out as follows:—

Country.	Milk-consumption in oz. per day.	Country.	Milk-consumption in oz. per day.
India ...	7	Poland ...	22
France ...	30	Austria ...	30
Canada ...	35	Netherlands ...	35
U. S. A. ...	35	Germany ...	35
Belgium ...	35	Czekoslovakia ...	36
Great Britain ...	39	Denmark ...	40
Norway ...	43	Australia ...	45
Switzerland ...	49	New Zealand ...	56
Sweeden ...	61	Finland ...	63

This table shows how poor consumers of milk we are. We must really hasten to increase our milk-consumption and it is not too late. We must make a very earnest effort to increase our milk-consumption as it really means increasing our vitality, and longivity.

The next item considered in the cattle management section was the proper feeding of the milch-cattle. The following is a typical ration set out as a model for a cow producing 10 seers of milk per day.

Hay 5 seers costing	1/-	-/3/-
Succulent fodder costing	2/-	
Concentrates 4½ seers		-/3/5/-
Total charges of feeding		-/6/5/-

Nextly the various feeds usually fed to the cattle in the localities near about were kept for demonstration.

Agricultural chemistry section.—The most interesting thing here was the detection of adulteration of the pure ghee with the cheaper vegetable ghee that is usually met with in the market and is not detected in appreciable amounts. The test is quite simple and not at all laborious or one taking a very long time. The procedure is as follows. Equal quantities of the ghee to be tested and ordinary glacial pure acetic acid are taken in a test-tube and heated till the whole becomes quite clear due to solution of the one into the other. The temperature at which pure ghee becomes quite clear in acetic acid is 40°C and that of pure vegetable ghee is 100°C. If the ghee in question becomes clear at any temperature between the above two temperatures the temperature is regulated by the amounts of pure and vegetable ghee present therein. This also indicates the approximate amount of the adulteration.

Then came the various apparatus used for dusting and spraying of plants. There was the apparatus for the dusting of juar seeds against the smut-fungus. There was also the apparatus used commonly for spraying Bordeaux mixture. There were also kept specimens of various plant-tissues affected with different fungus and bacterial diseases like the rusts and leaf-blight, and the leaf-curling of the chilli plant, the wilt of cotton, etc.

Sann Hemp.—The fibre obtained from the first stowing was the best and greatest in amount. With varying seed-rates compared, the results showed that the seed-rate of 80 lbs per acre is the best. The next experiment was about harvesting the crop at different stages of the plant. Among these the best fibre was given by the crop harvested at the time of flowering. Finally the quality of fibre obtained with different waters used for retting the stalks was indicated. In this the best fibre was given by clean and flowing water, followed in quality by flowing water, standing water and dirty water respectively.

Next came the importance of harvesting hay in proper time. The best time as indicated by the analysis of the hay at different stages of the plant indicate that the percentage of protein in the hay harvested during the middle of October is the highest among all the samples obtained by harvests at different times as indicated below :—

Time of Harvest.	Protein in the grass.
Mid—October ...	4.2%
End—October ...	3.6%
Mid—November ...	3.1%
End—November ...	3.0%

From this one can easily realize the importance of harvesting hay in proper time as otherwise the feeding value is greatly reduced due to loss of Nitrogen.

Kirloskar Brothers' section.—This section contained all the agricultural requisites manufactured by Kirloskar Brothers. Among these were the Fodder Cutter (Price Rs. 25/-), the roller bearing pulley for the Mhote (Price Rs. 25/-), the Centrifugal pumps the different ploughs of the Turn-Wrest type. There were also Plough-chains useful for fastening bullocks to the ploughs. The spare parts of the different ploughs were also kept there. There was the Sugar-cane mill and the Star-Khurpi, and the Dredger for doing the operations of levelling the land.

Implements section.—This section was arranged by the Nagpur Experimental Farm and in this all the modern implements of tillage were kept for demonstration along with the country implements. There were the different ploughs, the common implements of interculture found among the cultivator and the Akola Hoe. Among the seed-drills were the Walker Seed-drill and the Hosier Seed-drill. Therewere the mowers and the scythe for harvesting the crops. The prices of all these were indicated on labels fastend to them. This section showed all the implements of modern agriculture that are on the Nagpur Farm.

The Oil-seeds specialist's section.—Here the most interesting thing was the extraction of fibre from the retted stalks of the linseed plant as a bye-product. The utilization of the fibre was demonstrated herein. The fibre extracted from the retted stalks is put through the Punjab Wheel after properly mixing it with the cotton fibre and spun into a yarn. The extraction of the fibre is done by putting it through the apparatus prepared by the Oil-seeds Specialist. The yarn is used to prepare ropes and many other things to which ordinary fibre is put to in commerce. Many things made out of this linseed fibre were kept in this section for demonstration. The strength of the ropes made from the linseed fibre is indicated by suspending equal weights from rope made from the ordinary cotton fibre and also from a rope made out of the linseed-fibre. In demonstration, the rope made out of linseed fibre was actually thinner than the cotton fibre rope. This indicates that the rope made out of linseed fibre is at least as strong as the ordinary rope.

The Entomologist's section.—In this section the main things kept were the different apparatus used for killing rats and insects that are very dangerous pests to crops. There was one dusting apparatus exhibited for dusting plants by employing a blast of wind. Rat-killing apparatus used cynamade as the poison to kill the rats.

By the side of the Entomologist's Section were the smaller sections of the Nagpur Orange Growers' Association and the Veterinary section along with the Section of Nene's Seeds and Plants. In this section grapes grown in the Garden of Messers Nene Bros. at Khamla were kept for sale. Messers Nene have made a very noteworthy effort to grow grapes in and round about Nagpur. The grapes are quite like any ordinary market-grapes and are cheaper to produce than they cost in the market thus making it possible to grow grapes in Nagpur. They had also

kept some grape-plants for sale at 8 as. each but the best planting time was the beginning of the rains and so they were not sold.

The Departmental section.—This section contained all the different varieties of the crops that are being recommended by the Department. Different varieties of the famous Coimbtore canes and the gur obtained from each were kept in this section. There were also varieties of the different crops of cotton, wheat, gram, ground-nut, linseed, paddy, tobacco and other crops of the province. There were also various charts showing the effects of various rotations on each crop in the rotation, the effects of moisture and manure on the growth of crops as a whole. A number of charts also indicated the advantages and the disadvantages of the different methods of growing paddy. The results of many experiments regarding the manuring and the yields were also tabulated so as to clearly indicate the value of the advice given regarding the cultivation of crops.

In this section arrangement was made for the distribution of different leaflets regarding plant diseases and their treatment, to all the cultivators so that they may thus get rid of the epedemics. Among these leaflets the most important were those on the Leaf-curling disease of the chilli plant and the remedies on the two types of attack. There was also an important leaflet on the economical and efficient eradication of Kans in areas infested with this pernicious weed. Another important leaflet was about the plantation of an Orange-garden. One of the most important leaflets supplied to the cultivators was the one on the manufacture of Synthetic Farm Yard Manure by the Compost system. Leaflets on control of field-rats, the Inderbella of the fruit trees, on saving crops against frost, on the control of Pachydiplosis oryzae in the rice-fields and on the cultivation of Soyabean were also distributed for information to the visitors.

The Economic Botanist's section.—This section supplemented in detail the section described above. The different strains of the various crops that are being recommended and evolved could be seen here along with the figures regarding their cultivation, merits and demerits. The crops of Soyabean, Cotton and Ground-nut had received the greatest attention, in this section. Samples of various varieties were kept along with detailed information on each of the varieties of the crop in question.

The Engineering section.—In this section one could see the sugar-cane mill working and the improved Sindewahi furnace preparing gur.

By use of this furnace, the cost of gur-making is considerably reduced in that no additional fuel other than megess is required for the evaporation of the juice. A section of the furnace was drawn and kept nearby for the sake of information. Nextly, there was demonstrated the working of the ordinary bullock-gear worked Rahat and the Centrifugal pump. Along with these there was also the demonstration of the working of a Crude Oil Engine. The engine exhibited was the A. B. C.—engine of German make and the model kept there could develop 8—9 b. h. p. It's cost was Rs. 1,000/.

Extracts

OUR BODY MINERALS

A great deal of work has been done on the subject of mineral metabolism in the body and many books have been written dealing solely with this topic. In a short article detail must, of necessity be neglected.

In a discussion of the mineral content of the body often too great emphasis is placed upon their utilization in bone and the fact that minerals have other functions is often obscured. The general functions of minerals are as follows.

1. They maintain the necessary osmotic pressure, surface tension and so forth in the body fluids and thus aid in absorption, excretion and secretion.

2. They are concerned in the relation of hydrogen non-concentration of blood and tissues. The normal acidity of blood is partially maintained by the carbonates and phosphates of sodium.

3. The irritability or ability to respond to stimuli of muscle and nerve is dependent upon, and influenced by the presence of certain inorganic substances. Calcium is necessary for the transfer of nervous impulses. In this connection there is an inter-relationship and balance between magnesium, calcium, sodium and potassium. By upsetting this balance, for example by the injection of magnesium sulphate, coma, anæsthesia and paralysis can be induced. The symptoms are rapidly alleviated by the injection of calcium chloride. On the other hand deficient amounts of calcium lead to hyperexcitability or increased nervous tension, and tetany, which is a spasmodic rigidity in some parts of the body, the muscles of the hand for example.

4. The rhythmicity of the heart beat is also dependent upon a proper balance between mineral elements. If a beating heart has a solution passed through it, of the proper concentration, of sodium chloride it soon stops beating. If calcium is added to the solution the heart resumes beating but fails to relax properly and finally stops in a state of contraction. Subsequent addition of potassium results in normal beating. It is essential, however to have a proper proportion between calcium and potassium, excess potassium resulting in failure of the heart to contract properly.

5. They are integral parts of living protoplasm. Phosphorous is an essential mineral in all cell nuclei (nucleoprotein) and in brain and nerve tissue (phospholipins).

6. They constitute the greater part of bones giving rigidity to the skeleton.

It is readily evident therefore, that minerals are extremely important to the physiological activity of any animal body as well as providing a frame-work for that body.

The approximate elementary composition of the adult human body is as follows:—

Element	Percentage.
Oxygen	65.0
Carbon	18.0
Hydrogen	10.0
Nitrogen	3.0
Calcium	1.5
Phosphorous	1.0
Potassium	.35
Sulphur	.25
Sodium	.15
Chlorine	.15
Magnesium	.05
Iron	.004
Manganese	.0003
Iodine	.00004
Copper	?
Zinc	?
Silicon	?
Aluminium	?
Fluorine	?

Mineral Metabolism of the diet—Sodium Chloride (Common Salt) Human ingestion of sodium chloride amounts to about 10 grams per day. Common salt plays an important part both in the blood and in the cell protoplasm. In the first place it is necessary to keep the Gobulins in solution. Gobulins are a class of simple proteins which are insoluble in water, soluble in dilute salt solutions and coagulable by heat. It is also concerned in determining the fineness of dispersion of the protein and lipoidal colloids of the blood and protoplasm. Lipoids of "lipins" are substances of a fatty nature and are found in all animal tissue. Sodium chloride, in general, is slightly stimulating in most tissues.

Sodium salts occur abundantly in the blood and in much lower concentration in the tissues. Pottassium salts occur, for the most part, in the soft tissues, in the corpuscles of the blood, the protoplasm of the muscles and other organs, and also in the highly specialized glandular fluids notably milk.

Potassium.—The potassium content of normal human blood plasma and serum varies between 16—22 milligrams per 100 c. c. Blood plasma contains about 1/12 as much potassium as sodium. In the tissues, however, the ratio is in favour of potassium as is the case in general in the protoplasm of all body cells. Potassium is essential for all animal life and it cannot be replaced by sodium. Mendel and Osborne have stated that sodium, potassium, magnesium, calcium, chlorine and phosphorous are all essential for growth and none of them can be replaced by other. The minimum requirements of potassium for the growth of children and health of adults has not been determined but it is unlikely that any diet could be so deficient in potassium as to cause any physiological change.

Calcium.—It has been estimated that 99 % of the calcium present in the body is contained in the bones, the remainder existing as an essential component of soft tissues and body fluids. Of magnesium only about 71 % is contained in the bones. The muscles contain considerably more magnesium than calcium; the blood contains more calcium than magnesium.

Calcium is required by every cell in the body although the role it plays is yet unknown. It has been determined, however, that if the ironic calcium in the blood falls below a certain level the nervous system becomes hyperirritable and tetany results. In general, calcium salts have a depressing effect upon the nervous system.

In the blood calcium is required for clotting. If it is not present blood will not clot and proper bone and tooth development will not take place if it is deficient.

Milk is undoubtedly the best food for providing calcium in diet. One quart of milk contains about 1.2 grams of calcium and 9 grams of phosphorous. Leafy vegetables also provide a good deal of calcium in a diet.

Magnesium.—Magnesium is required for every form of life which has thus far been investigated. Magnesium ions have an effect on the irritability of nervous tissue very similar to that of calcium ions, both being depressing ions and in their absence or when greatly reduced tetany results. But while magnesium and calcium ions each has a depressing action on the central nervous system they cannot be replaced in all relationships. Both are necessary for normal growth and life.

There is a very fundamental reaction in all cells in which magnesium ion cannot be replaced by calcium ion. This is in the activation of the enzyme co-zymase by which the phosphoric acid esters of glucose are made as a preliminary to glycolysis and further fermentation. Hence in the absence of magnesium ions yeast will not ferment dextrose, and magnesium in the ionic form is necessary for all growth and reproduction in cells, since this reaction is one of the most fundamental in all cells.

Iron and Copper.—Hemoglobin the red colouring material in blood consists of a proteinglobin and heme, an iron containing pigment. This compound is responsible for most of the oxygen carrying capacity of the blood.

Iron is essential for the formation of hemoglobin, in its absence nutritional anaemia results. In addition to iron in hemoglobin some is present in muscles, some as tissue iron and reserves of varying level in the spleen, liver and kidney. Iron is probably present in every living cell and seems to be concerned in vital activities, particularly physiological oxidations.

It seems to be generally agreed that, to be absorbed, iron must be soluble, ionizable and ultra-filterable. Reduced iron, ferric hydroxide and salts soluble in acid solutions meet these requirements.

The utilization of iron in rebuilding hemoglobin (hematopietic process) depends on minute traces of copper. The addition of pure iron results in an increase in the ion content of the liver and spleen but only

in the presence of copper is this stored iron used in the hemato. pietic process.

Iodine and Sulphur.—Iodine is necessary for the prevention of goitre in adults and the requirement for iodine is about 1 miligram per day. This amount can be supplied by the additions of a small quantity of an iodide to the salt.

A great deal of work has been done on sulphur and its role in protein metabolism. However it should suffice to know that it is a constitutent of all protein and as such is indispensable.

Many other minerals are found in the human body, Zinc boron, manganese and vanadium being a few. These are present in such small quantities, however, that there appears to be little likelihood of any deficiency in almost any diet. Very little has been learned concerning their specific functions.—*(From the works of Dr. H. Branion and others, by Don Laughland.)*

MARKETTING OF EGGS

To produce first-quality eggs a plentiful supply of green feed all the year round is necessary, and with few exceptions the growing of green feed is another aspect in favour of the cooler hill districts.

In order to decide whether an egg is fresh or otherwise it is necessary to test with the aid of a powerful light. By this means the size of the air-cell can be determined and, incidentally, whether an egg is fresh or stale. The air-cell is situated just inside the large end of a normal egg and whereas the cell can quite easily be seen when testing an egg a few hours or more old, they are difficult to find in an egg if tested immediately after being laid.

The shell of an egg is of porous nature. Consequently if the eggs are allowed to remain in the nests too long or after having been collected are placed in unsuitable places such as a warm or a too hot room, or worse still a room that is warm to hot and also has a draught passing through, it will cause the contents of an egg to dry out very rapidly. The more drying out that takes place the larger the air-cell becomes. So one can quite easily realize that it is possible that an egg say only two days old and having been treated in an unsatisfactory manner, may have as large an air-cell as a two week old that has been given the proper care and attention.

During the hot months the eggs should be collected at least twice or better three times a day from the nests. Any that are not perfectly clean should have the dirt removed as soon as possible. Eggs should be placed in the coolest room that is available, and also one free from direct draughts.

Reverting back to the shell of an egg, being of a porous nature, care must be taken when cleaning, that as little moisture as possible is used as there is a grave danger of dampness penetrating inside the shell when excessive moisture is applied.

The result of dampness getting inside an egg is the formation of a greenish mould, and hence rapid deterioration in quality.

Eggs should be forwarded to the packing floor as often as possible, and on no account less than twice per week in the summer months.

The old method of packing eggs in chaff has been, generally speaking dispensed with and the modern method is to to pack them in standard cases included in which are cardboard fillers—a space for each egg.

The latter method has proved itself a definite improvement in many ways over the chaff packing. When eggs are packed in chaff there is danger of the fine dust that is more or less found in chaff clogging up the pores of the shell thus causing damage. Again the eggs that are clean when packed in chaff will often be quite the reverse on arrival at the packing floors.

As the cells are just inside the large end it is only reasonable to expect that the eggs will carry to the best advantage when packed with their large end uppermost, so that the content of an egg is not weighing on the cell. If eggs are packed with small end uppermost, there is a danger of the air cell becoming fractured and when this is fractured the egg cannot be classed as first grade. Such details in packing are quite easily attended to when the cardboard containers are used, whereas they cannot be carried out with chaff packing.

The fractured air cell is a defect, perhaps more common than any other, in eggs that are being graded as not being up to the required standard for export overseas.

The position of the nests should always be in the coolest part of the laying house. Exposure to the full strong strength of the sun results in the contents of the egg especially the white being affected at the time of

collection. The necessity of collecting eggs frequently from nests cannot be over-emphasized, and when collecting eggs bumping the container on the ground or gate of the pens should be avoided, as this frequently causes much damage.

Shell grit should always be available for the laying hens when they so desire. It is also wise to add a small percentage to the mash fed to them every day, so that the hen that is careless in regard to helping herself from the shell grit hopper will consume some when she is fed with the mash. Broody hens should never be allowed to remain in the laying house as they cause much deterioration in the eggs if only allowed to sit on them for a few hours.

The infertile egg is preferable to the fertile egg for marketting and every effort should be made therefore to ensure that eggs for marketting purpose are infertile. When eggs are fertile and are exposed to the heat or sat on by a broody hen, germination will take place and soon the egg becomes a total loss.

It has been a fairly general practice to use kerosene or petrol tins for collecting eggs from nests. These containers are not suitable to secure the best results. They hold the heat too much, especially for the eggs at the bottom of the bucket. When full they hold approximately 200 eggs so that there is considerable weight on the eggs in the lower portion. The kerosene or the petrol tin has also the disadvantage of not being, rigid enough to withstand the weight causing the sides of the tin to press inwards when lifted with consequent result of crushing some of the eggs. Wicker baskets to hold about 100 eggs give the best service.

A suitable room for storing eggs while awaiting transport is a very necessary adjunct on any premises where eggs are being produced commercially. The room should be cool, well ventilated, and designed that the temperature is not unduly affected by the outside climatic conditions. An under-ground or partially underground room well ventilated, but free from draughts is recommended.

On no account should the eggs be handled more often than is necessary as every additional handling increases the risk of doing harm to eggs.

Where rail and road transport over long distances is necessary, some form of protection to minimize the vibration that takes place should be provided. Placing a straw mattress over the floor of the vehicle is a modern method in use, and an appreciable improvement in the quality of

the eggs is maintained.—(*The Journal of the Department of Agriculture of South Australia.*)

EGG PULP

Pulping eggs is a branch of the egg industry that has grown considerably during the last few years. Generally speaking the eggs that are used for pulp-making are those that have minor faults such as:—

Slightly larger air-cells than those required for the egg in the shell trade. Eggs with fractured air-cells, under-size pullet and mishapen eggs.

Some producers have an idea that an egg in any condition is good enough for pulp-making—This view is incorrect as it is reasonable to expect the manufacturers to make quality pulp by using only good-quality eggs or those with minor faults. The pulp-trade is a means of absorbing a large percentage of our surplus including the minor fault eggs.—(*The Journal of the Department of Agricultural of South Australia.*)

TEST YOUR SOIL

A garden plot or grain field is a tiny chemical laboratory, is made up of countless soil particles, contains complex and intricate chemical processes, and is never the same from week to week, changing as the crop draws on the plant food resources, modified by weather and seasons. The fertility of the garden or farm is directly dependent on what goes on in that earth zone where feeder roots draw sustenance from the earth.

In the past, soil testing to guide the grower has been largely confined to extensive laboratory processes and out of reach of the average grower. Now, however, there is available a simple field kit with which anyone can make tests of soil and determine from them the fertility of any given plot of ground.

As little as two dollars will secure a field kit of the simplest type. Any one who can read newspaper English and distinguish colours may, in a matter of minutes, learn the four principal tests on a soil sample.

The first and most important determination is whether a soil is neutral, acid or alkaline. Some crops, such as asparagus, alfalfa and heliotrope require a soil definitely alkaline. To put such plants in acid soil is inviting failure. Other plants, such as rhododendrons, cranberries, parsnip, and gardenias will be retarded or destroyed by alkalinity. Every soil test kit contains a pamphlet listing the alkali and acid preferences of plants and the degree of either conditions they demand. There are instructions as to how to change a soil from acid to alkali or the reverse.

The other three primary tests are for nitrogen, phosphorus, and potassium. These are the soil chemicals which are required in large quantity by growing plants. The objective of a soil test is to make certain that they are present in sufficient quantity and in the balance required by the crop being produced.

Nitrogen is the element chiefly required in leaf and stem growth. Such crops as cabbage and lettuce and blue-grass lawns draw heavily on the nitrogen in the soil. Phosphorus, content of soil is linked with the production of flowers and fruits. Any crop of orchard, flower garden, or grain field needs adequate phosphorus to "make the crop." Potassium stimulates root growth; such a crop as the lowly potato demands this element in the correct balance in the soil.

Each year gardeners and farmers spend millions for "complete" fertilizers that contain a set ratio of the three principal plant foods—nitrogen, phosphorus, and potassium. This gunshot application of plant foods may not have enough of one or too much of another chemical to supply the needs of the particular crop. The soil test shows what is present and what is lacking, and the grower may buy only those chemicals needed to make his soil highly productive. The possible economy is obvious, for the grower may now be paying out money needlessly for chemicals that are already present in his soil.

The technique is simple. With an ordinary spoon, dig two inches under the soil surface and scoop up a soil sample. It should be dry enough not to wad up under pressure. Each tube in the kit has a coloured cork; each colour is for an individual test and each test is made every time in the tube assigned to it. The test tube is filled one-fourth full of soil. The kit contains small bottles of test solutions. Selecting the one designate for the test being made, fill the test tube until it is half full. Cork it, shake it, and set it aside until earth particles settle. The liquid above the soil will take on a colour. This colour is the key to the test.

There are four colour charts in each test kit, one for each test. Match the colour of the liquid in the tube with a colour shade on the chart for the test being made. The shade or the tint of the chart will be designate by a key letter or number. Turning to the pamphlet, one finds, the answers all worked on. From the resulting data, one can make up his own fertilizer, "tailor-made," for his particular soil.—(*Scientific American, February, 1939.*)

ORANGE OIL

Oranges grow in abundance in the plains of the Punjab, and their production, is showing a steady increase. According to the figures supplied by the Marketting Officer of the Department of Agriculture, the production during the year 1934-35, of two principal varieties of oranges, namely Malta and Sangtara, was 5,24,256 and 7,11,271 maunds respectively. Hitherto these oranges were mostly consumed in eating, but recently the production of orange squashes etc, has been started on a small scale in the Punjab. The orange fruit is known to yield some other useful products as well, but these have not so far been extracted from it. The most important of them are orange oil and pectin; orange oil finds use in confectionery for flavouring as well as in perfumery and medicine. Pectin is used for the manufacture of food jellies. Local and foreign markets exist for both these products. With a view to study the possibilities for their production from the Punjab fruits, work was undertaken by the Department of Industries at its Industrial Research Laboratory in Shahdara. It has been found that the Punjab orange generally yields good quality orange oil and pectin. The preparation of pectin may be a little difficult matter, but orange oil from the peels can be extracted easily by the hand sponge process as used in Italy, which consists of pressing the peels between the two fingers of the hand and receiving the oil in a sponge from which it is later on removed. This method can be easily followed in Punjab homes by women-folk. The oil can also be recovered from peels by steam distillation in an ordinary distillation still. One and a half maunds of fresh peels yield by the latter method about one pound of oil at a total cost of Rs. 3-12-0. The local price of the oil is quoted at Rs. 5-0-0 per lb. Samples of the oil prepared in the Industrial Research Laboratory were sent to the various local dealers and consumers, all of whom have reported favourably about its quality. The industry is particularly suitable for firms which are engaged in the preparation of orange squashes—one such manufacturer at Amritsar has already started the extraction of orange oil. Last season he prepared about 50 lbs. of oil the whole of which was consumed locally in the manufacture of soda water, fruit, and other essences. In those areas of the province, specially the colonies, where orange peels can be collected easily and cheaply, the production of orange oil will be found to be profitable industry.—(*Rural India, December 1938.*)

THE STORY OF QUININE

Quinine is to-day known to every layman as a very good medicine against the most widespread of tropical diseases—malaria, but it was only at the end of the 19th Century that it was introduced into Europe by Robert Koch. To-day it is impossible to think of pharmacy without quinine, though it is not long since there were nearly international complications, as well as, a war, over the Cinchona bush, from the bark of which quinine is obtained..

The plant originated from Peru, and was well-known to the natives. One day, the beautiful Countess de Cinchon, wife of the Viceroy of Peru fell ill from fever without white doctors being able to help her. An Inca, one of the natives, who was devoted to her, brought the bark of a strange tree from the jungle, and cured her with the medicine he prepared from it. Soon the value of this plant became recognised. At first, the Jesuits began widespread trade with it: then Spain built up a monopoly with this only weapon against fever. The plants were strictly guarded, but at last Dutch agents succeeded in taking away some shoots, and so this plant came to Java. At first, the Dutchman Weddell tried to plant some smuggled shoots in Algeria, but without success—only one plant survived. Then in 1852, with extreme care, this plant was sent to Java the parent of all the Cinchona trees in the Dutch East Indies.

White Gold.—Now Holland was in the possession of it. She freed herself from the Spanish market, and at once built up another monopoly, which controlled the export of the Dutch East Indies. England was not very pleased about this, and very soon also understood how to obtain these precious shoots which they cultivated in Ceylon. All these manipulations gave rise to numerous protests, firstly from Spain, then from England and Holland. Many people were killed in fights over the "white gold." But it was not only these fights which killed people, —the medicine itself did a lot of harm to mankind, until Robert Koch purified the quinine from the poisons which the chopped-up bark possessed besides its healing powers.

The word "quinine" comes from "Cinchona." After the Countess of Cinchon, and the natives of Peru, the Incas, called it "Polvo de la Condesa"—powder of the Countess, since she was the first white person to use it. Later it was called "Powder of the Jesuits," because they were the first to recognise its value as a medicine.

Forty species.—Botanically, "Cinchona" is the generic name for a large group of plants and trees of varying size, some reaching as much as 80 feet in height. The leaves are evergreen and the white or pinkish flowers have a pleasant odour. About forty different species of Cinchona have been distinguished, though only about a dozen of them have been economically utilised. Quinine is the most important and the most widely known of the numerous alkaloids (about 30) isolated from the Cinchona bark. Apart from its noted value as a specific against malaria the drug is found to have other valuable properties. It is a bactericide, a week solution of quinine being sufficient to kill many types of such organisms. It is intensely bitter in taste, inducing a reflex secretion of saliva and the gastric fluids. This means that the appetite is strengthened and digestion rendered more rapid and complete.

Most valuable of all.—Quinine has perhaps saved more human lives than any other single drug known to pharmacy. And in India, it has been widely available to the people through various distributive agencies. But its use is not without some adverse effects in certain cases. Cinchonism is the name given by doctors to the symptoms following the prolonged use of quinine. The patient becomes deaf and complains of ringing in the ears, these 'noises' taking peculiar forms, especially in musical people.

Nearly four centuries have elapsed since it saved the Countess of Cinchon from a malarial attack and still quinine forms the main weapon against this endemic disease. It is interesting to remember that this sole specific against a widely prevalent tropical disease is not a "discovery" of organised medicine but a chance gift of the natives of Peru to civilization.—(*The Hindu.*)

ETHYLENE TREATMENT OF TOBACCO

Ethylene, now widely applied for treating citrus fruits, English walnuts, and other fruits to induce ripening, has a beneficial effect on the curing of leaf tobacco. The treatment matures the leaves, improves the flavour and aroma of the tobacco, and reduces the curing period by as much as 40 percent. Investigations of the commercial application of this new treatment are being conducted by the British Colonial Office.—*D.H.K.*
(*"Scientific American" January, 1938.*)

VITAMINS IN OIL OF HALIBUT LIVERS

A source of vitamin A, more than a hundred times as potent as cod-liver oil, the present standard " bottled sunshine," has been found in oil from the liver of the food fish, halibut. Halibut-liver oil also contains an unusually large concentration of vitamin D.

The discoveries came from the joint research of scientists of two pharmaceutical laboratories. The workers are Dr. A. D. Emmett and Dr. O. D. Bird of Detroit and Dr. C. Nielson and Dr. H. J. Cannon of Chicago.

Halibut-liver oil was characterized as " super-concentrated sunshine." It was said to contain not less than 50,000 vitamin A units per gram.

" Under strictly comparable conditions," the report of the four research chemists stated, " the growth produced in experimental animals by halibut-liver oil compares favourably with that produced by doses of cod-liver oil 100 times greater. The halibut oil as prepared by special methods of extraction, has as a rule from 100 to 110 times the vitamin A potency of a 500 unit per gram cod-liver oil. The vitamin D content of halibut-liver oil, which has never been previously investigated, was also found to be unusually high."—*Science Service.*—(" *Scientific American* " *May—1938.*)

WHEY

A multitude of uses have been found for whey, formerly milk's equivalent of the famous pig's squeal that couldn't be set to work. Sweetened and dried, whey, a by-product of cheese manufacturing, makes an excellent candy filling. " Whipped cream" can be made from whey. Flavour and food value of canned or home-made soup is improved by the addition of powdered or condensed whey. Tomato juice and fresh whey, when mixed, form an " attractive" beverage or starting point for a variety of tomato soup.

This is the essence of a report by B. H. Webb of the United States Bureau of Dairy Industry before the Food Technology Conference at the Massachusetts Institute of Technology.

" The high nutritive value of whey has prompted the Bureau of Dairy Industry to investigate its use in food for man," Mr. Webb declared. " Whey contains most of the minerals, Lactose, and soluble protein of milk." Previously, he explained, small amounts had been used as stock food, only a "very small portion being utilized as human food".—(*Scientific American.*)

Use of sweetened whey or whey powder allows jam to be whipped to double its volume, Mr. Webb also reported. Canned fruit whips were another food listed by the speaker which whey improves.—(*Science Service.*)

BLOOD SPOTS IN EGGS

A small blood spot in an egg does not indicate that the egg is stale or bad, says the United States Department of Agriculture, in response to frequent inquiries. Blood spots are found occasionally in fresh eggs although this imperfection seldom occurs in the best grades of eggs that are candled and sold on the markets. Eggs from farm flocks are not so likely to contain blood spots as those from commercial flocks that are fed for maximum production.

The seasons when blood spots are most likely to occur are late spring when the hens are laying heavily and in the fall when the pullets begin to lay. Poultrymen who desire to remove all questionable eggs from those marketed should candle their entire production and use such eggs at home. Less forcing for egg production and liberal feeding of green feed will tend to reduce the formation of blood spots in eggs.

NAKED CIGARETTES

Mr. Stephen Tamas a well-known young Hungarian novelist and playwright, is responsible for an invention that bids fair to revolutionize the tobacco trade. He has solved the problem of doing away with 'paper smoke"—the reason why cigarettes are detrimental to the health of smokers, and proposes to put paper-less, "naked" cigarettes on the market.

Mr. Tamas' invention consists of a thin transparent substance made of tobacco extract. It is half the thickness of ordinary cigarette paper, and can substitute paper for the wrapping of cigarettes. This "tobacco film" tastes, smells and burns exactly like tobacco and allows the filling of the cigarette to be seen instead of hiding it like cigarette paper does.

"I am not a smoker myself" said Mr. Tamas, "I have never smoked a cigarette in my life, but I couldn't help thinking these little white sticks that all the world smokes, rather ugly. Doctors unanimously say that paper smoke is most unhealthy, too.

"So I cast about for a better solution, and after eighteen months of laboratory experimenting, we have found it. We call our invention 'naked paper' because it is practically invisible and leaves tobacco it contains, quite naked"

Stephen Tamas is the author of several successful books, plays and motion picture scenarios. He says he always hoped to see his name on an electric sign on Broadway some day, and apparently this dream is now coming true, though not quite in the way he thought.

"Naked cigarettes" will soon be on the market, for an American tobacco company is said to have offered Tamas 500,000 dollars in cash and five per cent of the profits for the exclusive rights of manufacturing them. Tamas has sailed for New York to negotiate the deal.—(*The Ill. Weekly of India, July 17, 1938.*)

GROWING CROPS IN CHEMICALS

Wake Island, in the Pacific, uninhabited until three years ago, and devoid of all but the hardiest forms of vegetation, is now the scene of one of the most unusual gardens to be found anywhere. This garden is an experiment in the new science of hydroponics.

The gardens which are a group of liquid-tight boxes filled with chemically-treated water in which a variety of crops are flourishing, were designed by the University of California to supply vegetables to men of Pan-American Airways and the United States Navy stationed at Wake Island, which is of growing significance in American defences in the Pacific.

The experiment has led to one of the most important possibilities which have yet been offered by this new science, which is that the taste and quality of the fruits and vegetables produced by this means can be controlled.—(*The Times of India.*)

CLOTHES FROM WOOD

Germany is not the only country to realise the possibilities of wood by-products in a wide variety of industries. Timber research specialists in England have achieved remarkable results, as a recent exhibition indicated.

The wife of an experimenter used a face powder produced from wood flour and commended it highly without knowing its origin. Other, and perhaps more important, commodities which can be obtained, wholly or partly, from trees are artificial silk, wood alcohol, sausage skins, wood sugar and cattle cake.

Wood can also be used very largely in the manufacture of cloth. Introduced into cotton goods it dispenses with 40 per cent of the cotton and a similar saving of wool can be achieved by a mixture of wool and

timber fibres. In the event of a wartime blockade. English forests would prove invaluable in the mitigation of hardship.—(*The Hindu*).

USING TOADS TO KILL INSECT PESTS

An expeditionary force of South American toads has been sent to Mauritius to wage war on the sugar cane pests. Toads were first used in biological control of pests about three year ago in Puerto Rico.

Later, they proved successful in the plantations of Queensland, and Puerto Rico is now building export trade in these animals.—(*The Hindu.*)

NEW TYPE OF GOAT FOUND IN SIND

A valuable type of goat, known as the Kamori, twice the size of the ordinary animal and yielding between eight to twelve pounds of milk daily, has been discovered in Sind by Live-stock merchants. Little appears to be known of this variety, which is found only with a particular tribe who tend the animals with great secrecy.

Enterprising dealers recently purchased some of these goats and sent them to the All-India Live-stock Supply Agency Farms in Central India. It is understood that a wagonload of these goats will be sent to Jodhpur shortly for stud purposes. Government propose to institute an inquiry in order to safeguard the animals from extinction as the result of uncontrolled export.

Now that specimens are available for breeding elsewhere, this Sindhi goat may become an important asset in India's Live-stock as is the well-known breed of red Sindhi cow—a cow which holds a milking record. Goats are cheaper to maintain than cows.—(*The Hindu.*)

EGG PRESERVING

There are several ways of preserving eggs, all simple and effective provided that the eggs are absolutely fresh to begin with, preferably no longer than 12 hours out of the nest. The shells too should be quite sound and on no account should they be scrubbed or washed before pickling.

If there is any doubt as to the freshness of an egg, hold it to the light in order to detect any tell-tale spots. Just as sure a test may be given by placing an egg in a solution of brine made by adding two ounces of salt to one pint of water. If the egg is fresh it will sink.

Methods of preserving.—One way is to cover each egg with a coat of mutton lard, or any other pure fat, and then pack them, pointed end downwards, into an earthenware crook or zinc pail, and surround or cover them with bran. Remember when using this method, use only pure fat, as the egg will absorb any other odour if it is at all tainted.

Another very simple method is to pack eggs in an air-tight tin between layers of coarse salt. The pointed end must be downwards and a two inch layer of salt must cover them on top. Next place a layer of thick paper or calico over them, then a tight-fitting lid. Store in a cool place.

The use of water-glass or sodium silicate, which can be bought at any general store, is a most satisfactory method for preserving eggs in the home. The eggs are packed, again pointed end downwards into a zinc-pail or earthenware crock. One gallon of boiling water is then added to one pound of water-glass and when the solution is cold it is poured over the eggs. They may then be left to use as required.—(*The Journal of the Dept. of Agriculture, South Australia.*)

MANGANESE AS MANURE

A special manure that has proved it's value for crops on Southern Yorke Peninsula in Australia is manganese. In the soils of the world it is most unusual to find a deficiency of manganese, but this has proved to be the case on land extending from near Warooka along the foot-like portion of Yorke Peninsula together with isolated spots in the vicinity of Port Lincoln.

The experimental work has been done with Barley, but in these areas a mixed manure of super phosphate and manganese sulphate is universally applied with all crops. The results of the experiments that have been conducted over the past six years show that the most profitable dressing is about 28 lbs. to the acre, whilst an application as low as 14 lbs. per acre has made all the difference between absolute failure and an eight bag crop in the manganese deficient patches.

The mixed manure is available commercially and is regularity used throughout the area mentioned, but in other districts of the State there is no lack of available manganese in the soil and consequently there is no advantage in adding this fertiliser.—(*The Journal of the Dept. of Agriculture of South Australia.*)

"SINGHARA" TO SUPPLEMENT SAGO

Indian water chestnut.—A possible source of good food available on a large scale to supplement sago, arrowroot and similar food stuffs, for which a good market, yet unexplored, exists in India and abroad, is Singhara or "Water Chestnut" (Trapa), according to the Industrial Section of the Indian Museum.—(*Botanical Survey of India.*)

There are thousands of suitable sheets of water which, given enterprise and cheap labour, could be made to yield rich crops of "Singhara." The extensive lake-like tanks of Southern India, the jheels of Central India and Bombay, the stagnant pools of East Bengal and Assam,—all can be placed successfully under cultivation for the Singhara.

The extensive cultivation of "Singhara—nut" in all localities where water abounds has been advocated at various time and experimental cultivation in the reservoirs and lakes of the Madras Presidency has been specially recommended.

The kernel of the nut is white and esculent and of a fine cartilaginous texture. Rich in starch, it is said to be equal in dietetic value to rice. It is agreeably flavoured, easily cooked and digested and supplements sago, arrowroot and similar foodstuffs, and may also be eaten raw, when fresh. Powdered and cooked with milk and sugar the nuts may be served as porridge. "Singhara" flour is a good diet for invalids. The unshelled nuts, when dry, can be carried far and stored to supplement cereal foodstuffs.

In medicine the nuts are used in diarrhoea and bilious affections for their cooling effects, and may be used externally in the form of poultice for scorpion sting. In certain parts of the country, the groundnut is used for making the 'gulal' powder ("Abir") which Hindus use during the Holi festival.—(*The Hitavada.*)

SKIM MILK FROCKS

Science supplies skim milk frocks.—Skim milk suits and dresses may soon be suggested by fashion experts. The U. S. Agricultural Department referred recently to the development of a process of making synthetic wool from casein, which is a by-product of skim milk.

The new fibre, it is said, has a chemical composition similar to wool-faintly yellow, and closely resembling the best grade of Merino wool. As for cost, it is stated that the fibre might be priced on a level with rayon,

a synthetic silk made from vegetable fibres. Because of an almost unlimited supply of skimmed milk in America, it would be possible for the Agricultural Department to produce as much as a billion pounds of the synthetic wool annually.

In Italy, where a somewhat different process for making casein fibre was announced three years ago, production on a commercial scale has begun. Most of the fabrics, however, are half synthetic fibre and half wool.

Feed or fibre.—To make the fibre, case in is softened in water and dissolved in a solution of caustic alkali. It becomes a thick, sticky mass and is carefully worked into the proper consistency by ageing, adding modifying agents and diluting. The mass is then forced through multiple spinnerets of the sort used in making rayon. The fibres are then separated and hardened in an acid bath containing formaldehyde and modifiers. In this way the fibre has a chemical composition almost identical with wool, except for a lower sulphur content.

As most of the skim milk remains on American farms to feed pigs and cattle, and as the manufacture is a factory process, which means that farmers have to take their milk to market, it is a debatable point whether the skim milk would be more valuable as feed or as fibre.—(*Illustrated Weekly of India.*)

ANCIENT FALLACY

The ancient seed-germination tale is continually cropping up. Not long ago it was reported that a dish of green peas had been grown from seed 4,000 years old. Usually these stories tell of Egyptian wheat, from a Pharaoh's tomb, which is claimed to have germinated in modern soil.

Both Sir Wallis Budge and Sir Rowland Biffen have dealt exhaustively and trenchantly with this demand on credulity. The former has said that people discovering that wheat found in tombs will grow believe it to be thousands of years old in spite of the fact that the wheat grown is not ancient Egyptian wheat at all.

At Mohenjo Daro.—In his opinion and experience no ancient wheat has ever germinated. The explanation of the matter is that the halls of ancient tombs, as well as stone sarcophagi and wooden coffins, have from ancient times downwards, been used to store grain, and grain has also been used as packing for mummies. This quite modern seed has filtered through into ancient coffins and of course germinates easily.—(*Illustrated Weekly of India.*)

Genuinely ancient grains of wheat were found during the excavation of Mohenjo Daro, but when crumbled between the fingers it turned to lifeless black dust—inert charcoal and nothing else.

PRESERVATION OF FORESTS

" The forests are a national asset and should not be destroyed. This is in the national interest and the national interest must not be subordinated to local or individual interest," says a Press Note issued by the Ministry of Public Information (Madras) with regard to the denudation of reserve forests.

The Press Note says that in the olden days a large part of the Peninsula was covered by forest growth, whereas at present the area of land under forest is limited to the ranges of hills and a few plains areas where the land is largely submarginal for cultivation. Even out of the forest areas now left to us, forest growth has shown a tendency in some places to deteriorate. Unless the public co-operate with the Forest Department so as to prevent further deterioration, the benefits conveyed by the forests will slowly but surely disappear. These benefits are not merely the visible benefits such as timber, fuel, bamboos, grazing, minor forest produce such as tan barks, medicinal plants etc. There are extremely important indirect benefits resulting from the existence of the forests. Chief among those is their value as conservers of soil and water which are vital to the existence of all.

In olden times when a vast area of forests was in existence, large numbers of the more backward tribes practised a primitive mode of agriculture now known as 'shifting cultivation.' Under this trees in an area—usually a few acres of forest—was cut down and burnt when dry enough, after which it was cultivated for two or three years until the natural fertility of the soil was exhausted when the cultivator moved somewhere else to repeat the process. The result of such a practice was the patchy destruction of vast areas of valuable hill forests, while the abandoning of the areas without any attempt at reclamation encouraged erosion and caused many landslips resulting in the drying up of the springs in the vicinity and the silting up of streams, wells and tanks down below. The results of this widespread practice can still be seen in many parts of Madras such as the Upper Godavari, Kurnool, Javadi, Nilgiri and Palni forests.

So far as forest areas are concerned, this practice has been largely checked, and the people who practised it have been encouraged to settle down in definite areas and have been given forest work to do. They have

also been encouraged to plant trees in the areas cleared by them so that when they vacate these areas, the young tree crop remains to come to maturity.

More serious than the shifting cultivation, however, are two factors which have in the past done and still are doing untold damage to the national forests. These are forest fires and unregulated grazing. Of these the more serious is the forest fire and this is, therefore, dealt with first.

Every year in the months of March, April and May we see hill fires raging through the forests carrying destruction and devastation in their path. Not only do they kill the trees but they kill saplings and seedlings, often destroying the regeneration work of several decades. They destroy the ground cover and leave the soil bare to be washed away by the first thunder showers that tell of the approach of the rains. This soil cover is extremely important to the resident in the plains. It consists largely of dead leaves which keep the surface soil in such a condition that it can absorb the maximum moisture from the rains and pass it down through the capillaries of the soil to the subsoil, whence it gradually passes to feed the springs, which in their turn feed the streams and the wells down below. In the drier districts of Madras these subsoil water supplies are of vital importance to the existence of the villager and his cattle in the hot weather. The destruction of large areas of poor scrub jungle in the Ceded Districts, which at the time seemed of such little importance is now recoiling with no small force on the heads of the present generation. The subsoil water-table is falling year by year and has already cost the local residents not merely lakhs but crores of rupees for deepening their wells. It is not surprising that famine and pestilence visit these areas with increasing frequency and at such cost to the State.

Not 5 per cent of forest fires are due to spontaneous combustion, lightning and the like. Experience shows that in 90 cases out of 100 fire can be traced back to the hand of man, be he the wayfarer, the grazier or the collector of minor forest produce. 75 per cent of our forest fires are caused deliberately, some by the grazier to get an early flush of grass in a time of scarcity and others by the coolies employed to collect minor forest products such as gallnuts which cannot be readily seen amongst the dry stalks of grass. Not a few cases have been traced to enmity between a villager and a forest subordinate.

It can be stated without any fear of contradiction that if it were possible to exclude man from our national forests fires would not occur except on very rare occasions. Propaganda can, however, achieve

marvels. If, therefore, the educated public will try to understand how these forest fires adversely affect their own interests, and those of their children and grand children and will explain this to those who have not the ability or the opportunity to read about it the position will improve considerably.

Our forests produce grazing for over 1½ millions of animals, and are capable of accommodating more, but only if the grazing is properly managed. Unregulated grazing is responsible for the bare condition of many of our marginal forests. Cattle feed chiefly on grasses and if good grass is available, the damage done to tree growth is very small. At present the grasses never get a chance to grow. No sooner do they put forth a leaf, than it is eaten by the cattle. Higherto any attempt to give some measure of protection to the grasses, by a period of closure, has always met with the opposition of the grazier, who looks upon it as a restriction of what he considers to be his right to wander here, there and everywhere with his cattle. If, however, he were to realise that if the grass could only get a rest, periodically, it would produce far more leaf than if grazed continuously, his opposition could gradually be overcome.

The result of overgrazing is similar in some respects to that of fires. The bare soil has no absorptive capacity and allows such water as falls to run away (carrying with it the surface soil), instead of absorbing it as a contribution to subsoil water reserves. Heavy run-off means erosion or loss of soil and this in turn results in devastation and even in the formation of desert.

The Forest Department is now trying to introduce periodical closures of grazing areas, not with a view to excluding the grazing animal, but in order to provide it with more food. Again propaganda is very necessary by the more educated public to encourage the graziers to give these new systems a fair trial. They involve chiefly the control of the animal (which is what the grazier is paid for). Without such control deterioration will continue.—(*The Hindu.*)

Radio.—A Jackson County, Michigan, farmer says that the most important place for a radio is in the barn. He switches his on with the milker at six o'clock in the morning, and gets the weather report and the news. The day is planned by the weather report. Later he gets market prices. Radio programs during the chore hours make the time pass rapidly and pleasantly, he says.—("*The Furrow*".)

OBITUARY

We regret to announce the untimely demise of Messrs N. K. Bishwas and Shiwaraj Singh Agricultural Assistants in the C. P. Agricultural Department. We offer our heartfelt condolences to the bereaved members of their families.

College Notes

NAGPUR UNIVERSITY EXAMINATION RESULTS, 1939

The following students are declared to have passed in the I. Sc. (Agr.) Examination 1939 in the divisions noted against their names.

Name		Name	
Babulal Nema	1	S. L. Gadwe	2
B. C. Pradhan	1	S. L. Patni	2
K. S. Krishna Rao	2	V. V. Gokhale	2
D. K. Sohoni	2	W. P. Sole	2
H. S. Dabir	2	D. P. Keote	3
K. P. Lele	2	M. H. Huddar	3
L N. Malviya	2	P. S. Thakur	3
M. K. Oka	2	A. D. Kane	Pass
M. K. Shinguarey	2	B. K. Zinjarde	"
P. C. Khare	2	G. D. Hishikar	"
P. V. Deo	2	P. C. Verma	"
R. N. Bhargava	2	R. S. Mehta	"
R. P. Jyotishi	2	V. L. Golhar	"
R. S. Chouhan	2	S. N. Joshi	"
S. R. Abhyankar	2	V. R. Deshmukh	"
S. N Shriwastav	2		

Under the provisions of paragraph 12 of Ordinance No. 17, the following examinees are declared eligible to present themselves at one or more subsequent examinations, only in Agriculture.

Name		Name	
K. K. Bhargava	Agriculture	M. V. Lele	Agriculture
K. M. Singh	"	S. S. Khokle	"

Sir Arthur Blennerhassett Memorial Medal is awarded to Babulal Nema, for standing first at the Intermediate Examination in Science (Agr.) of 1939.

B. Sc. (Agr.) Examination Results—1939.

Name		Name	
M. V. Gokhale	2	S. K. Husain Mosavi	3
B. G. Ghawghawe	2	V. G. Deodhar	3
D. G. Dakshindas	2	W. S. Vyawahare	3
G. P. Deshpande	2	B. S. Shukla	Pass
G. R. Tatwawadi	2	M. D. Patil	"
M. C. Gangarade	2	R. K. Wadaskar	"
N. Y. Karkare	2	H. N. Mukerji	"
P. V. Bapat	2	K. R. P. Nair	"
V. D. Deshpande	2	N. T. Saoji	"
G. V. Dhoke	3	T. M. Koyal	"
P. R. Roday	3	V. S. Kulkarni	"

Under the provisions of paragraph 11 of Ordinance No. 18, the following examinee is declared eligible to present himself at one or more subsequent examinations, only in the subject noted against his name :—

Dayal Chand Jain—Agriculture

Sir Arthur Blennerhassett Memorial Medal is awarded to M. V. Gokahle, for standing first at the B. Sc. (Agr.) Examination of 1939.

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Editorial

With this issue the Nagpur Agricultural College Magazine commences its XIV Annual Volume. The purpose of this Magazine is expressed by Science and Practice. The farmer of today would like to be kept in touch with the results of Scientific Research applied to Agriculture in his own province and elsewhere. All attempts are made to make the journal informative and of practical application. We extend to our contributors our thanks for the last year and hope that they will continue to enrich the pages of the Magazine. We rely on our readers to co-operate with the Magazine Committee in extending the usefulness of the Magazine as widely as possible.

* * * *

We have great pleasure in offering our felicitations to Rai Bahadur G. R. Dutt, B. A. and Rao Bahadur D. V. Bal M. Sc. (Hon.) the recipients of these birthday honours. Since Rai Bahadur Dutt has now retired it has been a fitting tribute to the meritorious services rendered by him during his service. For Rao Bahadur D. V. Bal, we trust this to be the precursor of many more honours to come.

* * * *

Mr. J. C. Mc Dougall, M. A., B. Sc., Director of Agriculture; and Mr. E. A. H. Churchill, B Sc. have proceeded home on leave. We wish them a happy time during their well earned respite.

1562

To Mr. R. H. Hill, M. A. and Mr. J. F. Dastur, M. Sc., who are elevated respectively as Officiating Director of Agriculture and Officiating Principal, College of Agriculture, Nagpur, we offer our hearty congratulations.

ANIMAL NUTRITION AND POULTRY RESEARCH

Buildings at Izatnagar near Bareilly meant for housing the two new sections of the Imperial Veterinary Research Institute have been opened by His Excellency the Viceroy on March, 12, 1939. It is also proposed to add in course of time a genetic institute and biological products section. The newly opened sections contain a library, one of the best in India as regards Nutritional Science, and the Physiological Laboratories, where the Physiology of Indian domestic animals is being studied and data collected. The laboratories contain mills, gas and electric ovens, incubators, refrigerators, sterilizers, centrifuges etc. The opening of these new sections marks a notable advance in the development of Animal Husbandry on scientific lines in this country which with its estimated total of 215,000,000 domestic animals carries over one-fourth of the world's stock of cattle and two-thirds of its' buffaloes. In addition she sustains nearly 97,000,000, sheep and goats. The estimated figure for domestic, fowls is at 173,000,000 birds.

The following observations made by His Excellency the Viceroy on the occasion of the opening ceremony of the two sections will be of great value.

" It is a matter of common observation that in the medical profession the progress of attention has been from cure of disease to prevention of disease and then to the establishment of health. The progress does not mean that medical interest is directed towards the latter aim in substitution of the former. It merely indicates that with the growth of human knowledge and experience and of a proper understanding and use of scientific inquiry, attention which at first is confined to phenomena extends itself to cover causes. The general trend of veterinary activities

presents a good example of this general progress which I have described. Let me explain. The first point I would emphasise is the vastness of Indias animal population. It is generally agreed that this aggregate of domestic animals is larger than is required in a properly balanced economy and that it imposes a too heavy demand in terms of fodder, and feeding stuffs. There can be little doubt that the prevelance of animal disease in India is the main clue to the enormous stock of animals which India houses. In the past very heavy losses have been suffered from contagious diseases of animals such as Rinderpest, Anthrax, Surra and the like. These losses menaced often the actual carrying out of agricultural operations, which since their timing and rotation is fixed by the cycle of the seasons must be punctually carried out and will indeed wait for no man. In India the bullock is almost the only source of tractive power and epidemics of animal disease may deprive the cultivator, both of the value of his working bullocks and of a large part of his crop. So long therefore as disease reigned more or less uncontrolled, the cultivator and all those who depended on the use of animals tended to carry a very large stock of them, since experience had taught that in the event of epizootic disease there would then be the chance of sufficient animals surviving to enable them at least to carry on. Clearly under conditions where these diseases had more or less a free run, numbers were important than quality, and with overstocking and consequent shortage of fodder, it was unlikely that the average cultivator would maintain animals of substantial value.

A first and essential step towards the improvement of the quality of our stock has been the control of animal diseases and it was to meet this need that this institute was founded almost 50 years ago. The decades intervening provide a record of the success in this most important aim. This institute has established a deserved reputation and if animal disease is no longer the terror in India than it was half a century ago, much of the credit must be given to this and to similar establishments elsewhere, which have

concentrated on the study of animal diseases and on the production of remedies and preventives for them.

This importance of preventive work which is the second in the sequence I mentioned was early realised and those in charge of the institute set themselves to organising this side of veterinary work. The rinderpest vaccine in the development of which this institute played a distinguished part is an illustration of the results of continued efficient research, for it represents a comparatively cheap and easy method of bringing the rinderpest under control. The annual production of anti-rinderpest serum alone is over 700,000 doses, while the figures for other sera are equally of impressive dimensions.

The third stage in the sequence which I mentioned was the establishment of health, which means for veterinary purposes, the establishment of animal well-being and of the general condition which will strengthen the animals resistence and improve its quality. The more I travel round India, the more I reflect on the deeper and more intimate problems of her rural economy and the physical well-being of her millions, the more am I confirmed in the importance I attach to raising the quality of her cattle and animal population. To the great mass of the inhabitants good animals mean better and more profitable farming and more nourishing food. No effort should be spared to see that the resources of science and technical skill are devoted to examining the improvement of animal nutrition. The animal nutrition branch of the Imperial Veterinary Research Institute will supply a most important need.

The part played by disease as the opponent of quality of production applies markedly in the case of poultry also in India. So long as disease regularly sweeps off birds in large numbers there can be no sufficient incentive for ordinary owners to go in for quality as against quantity. In comparison with world figures Indias total of domestic fowls, and ducks may not be so striking as the animal total. Nevertheless the gross figure of domestic fowls

in India is estimated at 173,000,000 birds—a figure from which the dimensions of the problem and the opportunity can be at once realised. A point of great interest is that the institute is getting into grips at first hand with the commercial problem of the industry. I am convinced that there is great scope in India for the development of the Poultry Industry."

CENTRAL PROVINCES AND BERAR AGRICULTURAL EXHIBITION, TRIPURI

By Mr. R. N. Misra, M. Sc.

AND

Mr. D. P. Parsai, B. Ag.

(Department of Agriculture, Central Provinces, Nagpur).

Introduction.—The Department of Agriculture, C. P. and Berar has rarely missed an opportunity whenever it was available to hold an Agricultural Exhibition with a view to demonstrate the growing of improved crops as well as the most modern and scientific methods of cultivation. A stalls-shed was, therefore, engaged by the Agricultural Department in the All India Khadi and Village Crafts Exhibition at Tripuri where the various sections of the department had kept suitable exhibits to demonstrate their activities as far as possible in the popular language for the benefit of cultivators. The shed was tastefully decorated and was fully equipped to the utmost advantage of practical agriculturists, with the result that Pandit Jawahar Lal Nehru who had a cursory round through the Exhibition before performing its opening ceremony made a special appreciative reference regarding the agricultural show in his inagural address and visited the stalls again with the Hon'ble Mrs. Vijayalaxmi Pandit going into the minutest details of the exhibits of all the departmental sections represented there. The exhibition lasted for about eight days and the agricultural show was very much appreciated and copious notes were taken by visitors from the remotest corners of India.

A rough sketch of the agricultural stalls of the exhibition is given herewith indicating the positions of different sections. The order of description in the present article is in accordance with the order which

the visitors had to follow as soon as they entered the agricultural stall's-shed.

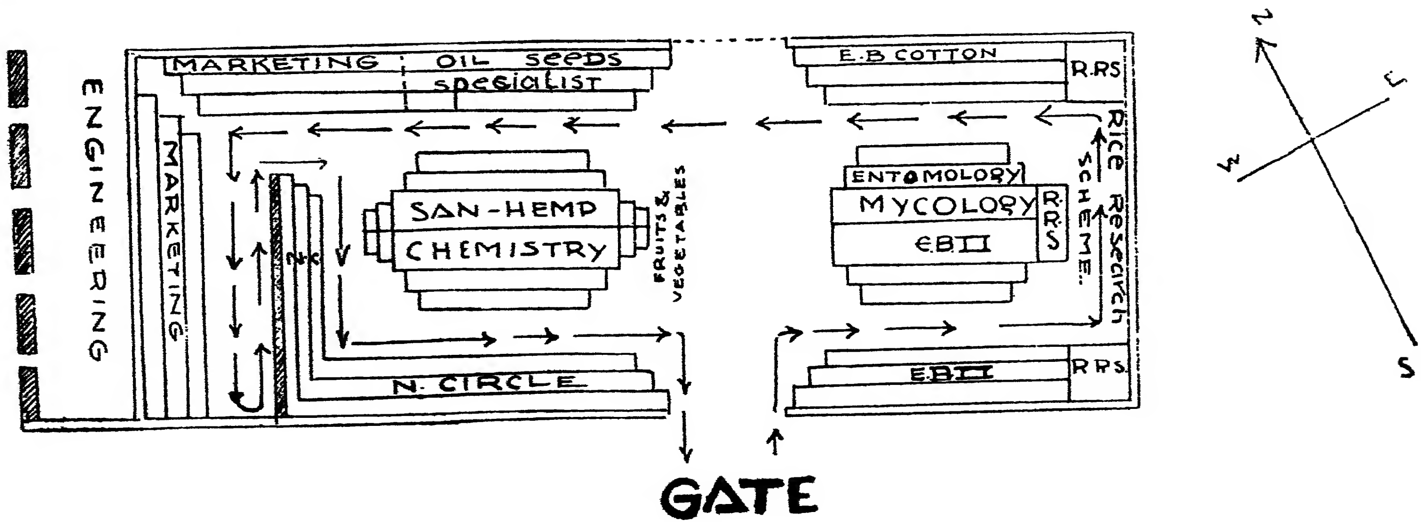
2nd Economic Botanist's wing.—Consisted of 35 exhibits of the following crops, viz. wheat, gram, tur, urid, castor, leguminous fodder and fodder grasses. In addition to the exhibits there were a number of charts illustrating the exhibits and furnishing detailed information regarding the seeds of the improved crops. Wheat crosses A 115 and A 113 were particularly liked by the visitors, while gram varieties D 8, 352, 62 and 28 attracted considerable attention. Amongst the *tur* selections E. B. 38 and No. 3 were much appreciated, the former being wilt resitant and the latter high yielding and early maturing. In addition this wing was rather prominent on account of the presence of the various types of fodder grasses and some posters which loudly proclaimed that "The mixture of all these grasses when sown judiciously supresses the growth of the spear grass (Andropogon Cantartus).

Rice Research Scheme's wing.—Exhibits were presented in the following order:—(1) On the wall samples of ears of about 700 types of rices grown in the province were arranged. (2) The right hand table contained the selected high yielding varieties of rice. (3) The left hand table on the other hand had the selected fragrant varieties of rice. (4) The table facing the wall exhibited the hybrids by which the problem of the eradication of the wild rice *Karga* can be solved.

In addition to these exhibits there was a large number of posters giving useful information about the rice cultivation in the province. Paddy occupies about 23% of the total cultivated land of C. P. and Berar. The chief paddy growing tracts are Chhattisgarh, Wainganga Valley and some parts of the northern districts. The surface colours exhibited on the seed of the various varieties of paddy were (1) white, (2) red striped, (3) red, (4) black and (5) mottled. The size of rice got out of them differs, varying from 5 m. m. to 8 m. m. in length. Five methods of rice cultivation prevail in the province i. e. transplantation, *biyasi*, *machonha*, *lehi* and broad-casting. Different tracts have got their special favourite varieties to grow, viz. (1) early maturing, (2) medium and (3) late. Loss due to *Karga* is nearly 30%.

Average outturn of paddy per acre in India is 964 lbs. which is the lowest in the world; and C. P. (yielding 650 lbs. per acre) stands lowest in India. *Karga* could not be weeded out at early stages from rice fields. Various crosses have been tried to introduce some prominent morphological distinguishing characters and success has been achieved in the following cases:—

SKETCH OF THE AGRICULTURAL EXHIBITION
TRIPURI



(1) No. 116 (*Bhondu* x *Parewa*).

(2) No. 19 (*Budhia Bako* x *Parewa*).

The following general points are recommended for having a better outturn of paddy :—

(i) To sow high yielding varieties of paddy, (ii) manuring, (iii) good cultivation, (iv) irrigation and (v) to guard against pests and diseases.

The best combination of manure suggested is 100 lbs. ammonium sulphate and 100 lbs, superphosphate grade II per acre. This gives an outturn of 1582 lbs. as against 879 lbs. of paddy without any manure.

This section was a source of special interest for the people of Bengal, Bombay, Bihar and Madras.

Economic Botanist for Cotton's Section.—Exhibits sent by the Economic Botanist for Cotton, C. P., Nagpur were samples from four crops, i. e. cotton, groundnut, *juar* and *Bajra* given in the following table :—

Cotton	1. Seed cotton 2. Lint in small 1 lb. bales.	Groundnut (pods)	Juar (grains)	Bajra (grains)
1. Verum 262 2. Verum 434 3. Late Verum 4. No. 438 5. Bani 306 6. E. B. 31 7. Buri 107	8. B. 29 9. B. 90 10. H. 420 11. H. 415 12. H. 414 13. Roseum	1. Ak. 10 2. Ak. 8—11 3. Ak. 12—24 4. Imp. small Japan 5. Imp. Spanish peanut	1. Improved Saoner 2. Improved Ramkel 3. E. B. 1 4. No 123-A	1. No. 14-D 2. No. 32-C 3. Jamnagar type 1. 4. Jamnagar type 2. 5. Awned Bajra No. 3

Roseum cotton was the shortest stapled in the lot while Bani was the longest. This wing attracted the attention of the people specially from cotton tracts of the Province, U. P., Bihar and Bombay Presidency.

Mycological and Entomological Sections.—Exhibits sent had the specimens of the diseases of cotton, juar, wheat, betel leaves (*pan*), oranges, potatoes, tomatoes, sugarcanes. The causes, preventive and curative measures were given on the specimen cards which were also verbally explained to the visitors, who appeared to be more keen about the wilt and anthracnose diseases of cotton, smuts of juar, wheat rust, anthracnose and footrot of *pan* and redrot of sugarcane.

The exhibit of special interest in this section was the machine devised by the Mycological Section, for copper carbonate treatment of juar seeds against smut.

Entomological exhibits consisted of specimens of important crop pests of the province, their life-histories and control measures. Cotton boll worms (Earias fabia, E. insulana and platyedra gossypiella) were the pests in which visitors were interested.

Oil Seeds Specialist's Section.—Among the exhibits were:—(1) retted linseed stalks, (2) linseed fibre (crude), (3) linseed fibre (cottonised), (4) cottonised linseed fibre mixed with cotton in various proportions, (5) ropes, *jot, payahiya, girwan*, etc. the articles of agricultural utility, (6) yarn from cottonised linseed fibre and *galicha*, curtains, and suiting cloth made out of the yarn, (7) samples of improved linseed varieties.

The object of special attraction in this section was the fibre extracting machine devised by the Oil Seeds Specialist, C. P., the working of which was demonstrated to the visitors. Linseed stalks which so far were little better than a waste to the agriculturists could yield a useful material viz. fibre, from which it is possible to prepare articles of every day use like ropes, carpets, *galichas* and even cloth.

This gives an impetus for one more cottage industry in the province which at the rate of nearly 50 to 60 lbs. fibre per acre promises to give an income of nearly Rs. 4/- per acre. The total area under linseed in the Central Provinces alone is nearly one million acre.

Marketing Section.—Exhibits contained:—(1) market samples of various grains, ghee, leather etc. (indicating their adulteration, lack of grading and mishandling), (2) certified ghee sample (Agmark) graded eggs, and oranges, (showing their indigenous and improved methods of packing and the benefits of the latter), (3) a large number of charts and graphs, illustrating acreage, production, consumption, export and import of various commodities, trend in the variation of prices and cattle population, (4) different weights and measures used in the various markets all over the province (indicating the lack of uniformity, as well as practice of fraud), (5) a toy model demonstrating in an interesting way the benefits of the transport of cattle by rail over that of road. This model had much attraction for the visitors. Suggestions were made by certain visitors to arrange for the display of such models by the railway authorities on the important stations.

The various problems of marketing, viz. grading of crop-products, standardisation of weights and measures, regulation of markets with a view to provide more money and facilities for the grower etc. were also verbally explained with the help of the exhibits and charts.

An illustration of what percentage of the price offered by consumer (say at Lahore) goes to the producer in the case of Nagpur Oranges is given below:—

		Rs.	A.	P.	Percentage
1.	Cultivator ...	0	3	1	19.2
2.	Contractor's expenses ...	0	0	9	4.8
3.	Contractor's gain ...	0	1	2	7.1
4.	Basket packing charges ...	0	1	1	7.0
5.	*Dalali* ...	0	0	6	3.2
6.	Railway charges ...	0	5	7	34.7
7.	Lahore expenses ...	0	1	2	7.1
8.	Lahore contractor's commission...	0	0	10	5.5
9.	Nagpur *Dalal's* profit ...	0	0	7	3.7
10.	Retail dealer's profit at Lahore ...	0	1	3	7.7
					100.0

Chemical Section.—Exhibits from the Agricultural Chemist's Section consisted of:—(1) models exhibiting the mechanical composition of the various typical soils of C. P. and Berar, (2) manures, (3) feeding stuffs, and (4) many charts illustrating the effects of manuring and rotation of crops, fixation of atmospheric nitrogen by various leguminous crops, amount of plant food removed by certain important crops from the soil per acre, ill-balanced and well-balanced diets etc.

Soils	Percentage on air dry soil							
	Coarse sand	Fine sand	Silt	Fine silt	Clay	Moisture	Loss on ignition	Calcium Carbonate
Morand	0.50	7.39	11.34	21 67	40.00	9.80	5.70	4.10
Kali	0.20	3.03	12.42	15.58	51.00	11.04	6.43	0.35
Sehar	13 58	27.57	23.49	14.01	12.96	5.32	3.06	Nil
Khardi Pathar	6.10	27.69	16.26	11.06	7.32	6.75	4.58	19.7
Dorsa	5.80	4.60	22.90	21.10	35.10	5.00	6.30	0.10
Bhata (stones and gravels) 70.05%	9.65	4.54	3.5	2.63	4.38	1.00	3.50	0.35

The models exhibiting the mechanical composition of soils consisted of tall stoppered glass cylinders filled with sand, silt and clay etc. to different heights representing their percentages in the respective soils as indicated in the table given above :—

Manures which were exhibited can be classified under three main heads according to the chief plant food they supply :—

Nitrogenous.—Nicifos I (14% N.), F. Y. M. (0. 7% N.), Art. F. Y. M. (0. 85% N.), $NaNO_3$ (15.5% N.), Ammonium Sulphate (20.6% N.), Castor Cake (3.6% N.), Karanji Cake (4.0% N).

Phosphatic.—Nocifos I (45.00% P_2O_5), F. Y. M. (0.35% P_2O_5), Art. F. Y. M. (0.60% P_2O_5), Superphosphate I (40—45% P_2O_5), Superphosphate II (18.2% P_2O_5).

Potassic.--Potassium Sulphate (48.0% K_2O).

Effect of organic manures on the yields of cotton and rice crops were exhibited quantitatively showing that both the crops are doubled by the application of organic manures viz. cowdung manure, and poudrette.

The exhibits of various feeding stuffs were also presented in tall glass cylinders showing their respective moisture, oil protein, carbohydrate, fibre, ash and sand in ash contents, as well as their food units.

Three samples of *gur* represented three methods of their preparation viz:—

1. usual method by using *bhendi* juice and heating to 119°C.,

2. the above usual method with the addition of sodium hydrosulphite (one tea-spoonful) in the end, and

3. the above usual method followed by filtering through activated paddy husk charcoal and adding sodium hydrosulphite as in (2). The sample of *gur* from the last treatment was the best of the three.

A mineral brick lick which was kept in the show, is prepared by the Agricultural Chemist, C. P. It is intended to cure the mineral deficiency in the cattle. It contains roughly 70% common salt, 5.0% calcium phosphate, 8.0% lime, 0.5% iron (as $FeCl_3$), 0 01% Iodide (as KI). The total cost of each brick weighing 7 lbs. is estimated to be Rs. 0/7/6.

The most remarkable exhibit in this section was the demonstration of a quick method of testing ghee for its adulteration with vegetable ghee. The method in short is as follows :—

Equal parts (say about 2 c. c. of each) of the sample under test and pure glacial acetic acid, are taken in a test tube fitted with a cork through which passes a Centigrade thermometer the bulb of which dips inside the stuff. The test tube with the contents is then slowly heated over a spirit lamp with constant stirring till both the liquids indicate miscibility and appear transparent. The temperature at which this phenomenon just occurs is noted.

Absolutely pure ghee is miscible in an equal volume of glacial acetic acid at 40° to 42° C while the same volume of pure vegetable ghee requires to be heated to 110° C to be miscible in its own volume of glacial acetic acid. There is, thus, a difference of about 60° between the miscibility temperatures of the two liquids in the same volume of glacial acetic acid. A temperature arrived at between 40° C to 110° C will indicate the extent of adulteration of ghee, by the help of a chart, which can be experimentally prepared. This being a quick method not requiring much apparatus and yet giving a roughly correct test of the purity of ghee, was very attentively observed and learnt by a large number of agriculturists, common public and also the dealers in ghee.

A wing was reserved for *Sann-Hemp Scheme* which exhibited the fibre produced from the following different treatments of sowing and retting:—

1. By sowing at different dates (early, medium and late).

2. By retting in different kinds of water (muddy and stagnant, as well as clear and running).

3. By using different seed rates in sowing (100, 80, 60, and 40 lbs. per acre).

The largest yield of long, strong and lustrous fibre was obtained from early sowing, using 80—100 lbs. seed per acre and retting the stalks in clear running water for 8—9 days in winter and 3—4 days in summer.

NORTHERN CIRCLE

Largest number of articles was presented from the above circle including:—

1. all the types of wheat grown in the Northern Circle,

2. all the various types of grams and other legumes grown in the Northern Circle,

3. all the kinds of sugarcane produced in the farms of Northern Circle,

4. the selected varieties of chillies,

5. fresh vegetables of unusually large growth, and

6. various modern farm implements (and their working).

Side by side with the above exhibits there were more than a hundred charts indicating the average weather conditions of various places in the province, and many popular agricultural sayings and mottos which themselves are a record of the experimental knowledge in villages, regarding practical agriculture, verbally handed down from generation to generation from times immemorial

The wheat A 115 and A 113 for open field and AO 90 for Haveli tract being comparatively more rust resistants and high yielding chiefly drew the attention of the visitors. Green gram of Gotegaon, Pandhurna Chillies, and Jamnagar giant variety of Bajra (a single ear = 2'--3' long) were viewed with astonishment by the people hailing from Berar and outside C. P., to such an extent that the seeds of the above were demanded in large quantities by certain visitors, who were, of course, directed to the proper authorities.

The Deputy Directors of Southern, Eastern and Western Circles had also sent their exhibits which were demonstrated along with those from Northern Circle. Oranges from Tharsa Farm were very much appreciated.

Big sized radish and beet-root (weighing 5 lbs.), huge cabbage (weighing 13 lbs)., and brinjals from Jubbulpore, oranges from Nagpur, and massive Scotland Potatoes from Benares University were amazingly attractive and interesting. Fresh vegetables for this section of the Exhibition were supplied mostly from Government Gardens, Pachmarhi.

Consolidation of holdings in C. P.—There were three charts presented by the Settlement Department showing fragmentation and sub-division of holdings in Chhattisgarh, the work done for consolidation and the benefits thereof. The following figures show the work done in Raipur, Bilaspur and Drug Districts up till now.

No. of villages consolidated	...	...	1443
Acreage consolidated ...	...	...	18,53,676 acres
Khasra Nos. before consolidation	...	...	29,15,213
Khasra Nos. after consolidation	...	...	4,40,811

Percentage reduction in Khasra Nos. ...			...	84%
Cost per acre ...	...	...	...	-/4/-

The cost in the beginning was Rs. 1/6/- per acre but now it has been reduced to Rs. -/4/- per acre. Thus, at a negligible cost one can get all the benefits of consolidation of holdings resulting in better and prosperous agriculture.

Agricultural Engineering Section.—In this section an engine run by producer gas was demonstrated and the possibility of its introduction into our villages was explained on the ground that it has a simple machinery and requires only a small quantity of charcoal, which could be easily had at a cheape rate in villages.

Animal Husbandry Section.—This section was conspicuous on account of the presence of dairy cows and buffaloes and also a bull, with an ordinary Indian village cow, for the sake of contrast in body development and milk yield. A special shed was errected for this section at a short distance from the agricultural show. Methods of cream separation, pasteurisation, butter making etc. were demonstrated practically as well as through charts.

Poultry section exhibited some typical improved breeds of poultry birds. Their management and artificial hatching of eggs was demonstrated to the visitors.

Many articles of common attraction like various milk products, sweet-meats, chicken eggs of unusual size, were presented in this section. Some easy and quick methods of detecting rotten eggs were demonstrated here. One of these methods is as follows :—

A thin cardboard is wrapped lengthwise round the egg in question leaving the two opposite ends open. By holding an open end of the egg, now, against the light (either day light or candle light) and looking through it from the other open end, the interior mass of the rotten egg looks opaque, while that of a sound egg appears transparent.

The exhibition continued for full one week and was attended by about a thousand visitors per day. The stalls opened at 8 a. m. and closed at 6 p.m. every day. The success of this Agricultural Exhibition was due to the untiring efforts of and keen interest through out taken by the Deputy Director of Agriculture, Northern Circle, and the co-operation of all the sections running under the Department of Agriculture, C. P. and Berar. The co-operation of the Department of Agriculture, Bombay and that of the Agricultural Research Institute, Benares is gratefully acknowledged.

RESPONSE OF WHEAT VARIETIES TO THE APPLICATION OF NITROGENOUS FERTILISERS UNDER HAVELI SYSTEM OF CULTIVATION

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AND

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Introduction.—An experiment was laid out at the Kheri Farm (Adhartal) to study the response of wheat varieties to the application of Nitrogenous fertilisers in the season 1938—39. The farm is about three miles from Adhartal, having Kabar II soil, a heavy black loam, typical of the embanked wheat area of the Jubbulpore Haveli, containing nearly 51% of clay, 17% of fine silt and 12% of silt.

The experiment consisted of investigating the effect of :—

1. Nicifos II at 15 lbs. of Nitrogen per acre, sown with seed.

2. Ammonium sulphate at 15 lbs. of Nitrogen per acre, sown with seed.

3. No manure.

On the following five varieties :—(a) A 090; (b) A 115; (c) P. 4; (d) P. 52; (e) P. 101.

Design of experiments.—The lay out of the experiment was a split-plot (1) design in which each block was divided into five sub-blocks to each of which one of the five varieties was assigned at random. Each sub-block was further divided into three equal parts, each of which received one of the three manurial treatments at random. The ultimate size of the plot was 1/40th acre and the replications adopted were five in number.

This lay out is in contrast to a complete randomisation of all the fifteen combinations possible in each block and involves two errors as a basis of comparison, viz. one error for the comparison of varieties and the other error for comparing the other effects, i.e., treatments and the interaction of treatments with varieties. It is obvious that in the

adoption of a split-plot design, the different effects cannot be compared with the same precision as two errors are involved.

Analysis of variance.—The plot yields for grain are given in the Appendix attached. The allocation of the amount of variation in yield due to various causes is shown in Table I, below.

TABLE I

Analysis of variance

Due to.	D.F.	Sum of squares.	Mean squares.	F.	5% F.	1% F.
Blocks ...	4	89.00	22.25	...	...	...
Varieties ...	4	83.00	20.75	9.304	3.01	4.77
Error (a) ...	16	35.67	2.23	...	...	...
Treatment ...	2	724.21	367.10	267.956	3.23	5.18
Varieties x Treatment...	8	36.96	4.62	3.372	2.18	2.99
Error (b) ...	40	54.83	1.37	...	...	...
Total...	74	1023.67	13.85			

Precision of the experiment.—As already observed, the split-plot technique employed in the experiment involves two errors as a basis of comparison, viz. one error for the comparison of varieties and the other for comparing the treatment effects and their interaction with varieties. One would expect, the error (b) to be smaller than error (a) as in the case of error (b) comparisons are made between closely adjacent small plots, which may be expected to differ less in soil fertility than the larger main plots, called sub-blocks, whose centres are further apart. In the present case the magnitude of error (b) is smaller than error (a) as was expected but the comparison of the mean squares shows that the two mean squares are not statistically significant the value of F (2) for $n_1=16$ and $n_2=40$ being only 1.62.

It is of interest, however, to estimate the error mean square if all the treatment combinations, had been randomised. This can be done by replacing each treatment mean square by corresponding mean square and obtaining the equivalent of a uniformity trial combining the two resultant error sums. The value so obtained is $\frac{20 \times 2.23 + 50 \times 1.37}{70} = \frac{113.10}{70} = 1.616$. On this basis, the accuracy of the varietal comparisons

would have been $\frac{2.23}{1.616}$ = 1.38 times the original information, while on the comparison involving nitrogen $\frac{1.37}{1.616}$ = 0.85 times the original. In the present case the split plot technique has not resulted in material gain or loss of information on the comparisons effected. The standard deviation per plot per error (a) and error (b) work out to 8.65 and 6.79% respectively.

Response of wheat varieties to fertilisers.—The analysis of variance at once shows that :—

1. The variance due to varieties is significantly greater than the variance due to error (a) indicating the significant varietal effect on the yield of grain,

2. treatment effect is also highly significant and that

3. different varieties have responded differently to the treatments, i. e., the interaction of varieties with treatments is significant.

Table II shows the mean yield per plot for the different wheat varieties tried.

TABLE II

Mean yield in lbs. per plot of 1/40th acre.

Varieties.	A. O. 90	P. 52	A. 115	P. 101	P. 4	Mean	S. E.
Yield	18.45	17.78	17.53	17.07	15.33	17.23	0.38

Mean yield per plot, taking all the varieties into consideration is given in Table III, for the different treatments tried. A. O. 90 has given the highest yield white P. 4 the lowest. A. O. 90 has yielded significantly more than P. 4 and P. 101.

TABLE III

Mean yield in lbs. per plot of 1/40th acre.

Treatment.	Nicifos II.	Ammonium sulphate.	No. manure.	Mean.	S. E.
Yield	21.16	16.98	13.56	17.23	0.234

Application of ammonium sulphate or Nicifos II has given significantly higher yields than the no manure plot and the application of Nicifos II has given significantly higher yield in comparsion with the application of ammonium sulphate.

As observed above, the interaction of fertiliser, with the varieties is significant. The result of yields obtained per plot for the different varieties under the treatments tried is given in Table IV below.

TABLE IV

Yield in lbs. per plot of 1/40th acre.

Variety	No. manure	Ammonium sulphate	Nicifos II	S. E.
A. O. 90	14.8	18.2	22.4	0.52
P. 52	15.4	17.1	20.8	
A. 115	12.8	17.0	22.8	
P. 101	12.8	17.8	20.1	
P. 4	12.0	14.8	19.2	

All the varieties have given significantly increased yields with the application of Nicifos II compared to the application of ammonium sulphate. A. 115 appears to respond best to the application of Nicifos II. P. 52 responded the least while P. 101 respond most to the application of ammonium sulphate. Under no manuring P. 52 and A.O.90 have given significantly higher yields than the other varieties which do not seem to differ amongst themselves in yield.

Economics of manuring.—Averaging all the varieties, the mean yields obtained per plot of 1/40th acre under the different manurial treatments are shown in Table III above. Expressed on an acre basis we obtain the following.

No. Nitrogen	Ammonium sulphate	Nicifos II
542	679	846

The extra cost of manure over and above the no. manure plot at the rate of 15 lbs. of nitrogen per acre is Rs. 4-8-3 for ammonium sulphate and Rs. 7-5-0 for Nicifos II. The relative profit or loss due to the application of the fertilisers is shown in the Table V, below.

TABLE V

Yield per acre in lbs.

Name of Fertiliser.	Excess yield in lbs. per acre.	Value in Rs. at 35 lbs. per rupee.	Extra cost of manure over no. manure plot.	Extra profit or loss per acre over no. manure plot in Rs.	
				Loss	Profit.
Ammonium sulphate ...	137	3-14-7	4-8-3	0-9-8	
Nicifos II ...	304	8-11-0	7-5-0	...	1-6-0

The results show that 15 lbs. of nitrogen in the form of Nicifos II was done at a profit of Rs. 1-6-0 per acre while application of $Am_2 SO_4$ at 15 lbs. of nitrogen was not economical, resulting in a loss of Rs. 0-9 8 per acre. This calculation has not, however, taken into consideration the value of excess straw obtained by the manurial treatments. Considering individual varieties, application of Nicifos II to P. 52 was, however, done at a loss of Rs. 1-2-3 compared to the no. manure plot.

The resume of previous manurial experiments on wheat shows that 20 to 30 lbs. of nitrogen, in the form of Nicifos II, was applied and although significant increase on yields was secured, it was done at a loss. A smaller dose of 15 lbs. of nitrogen seems profitable under the condition of the experiment. The conclusions of the present experiment suggest the laying out of a new experiment to investigate the lowest dose of nitrogen in the form of Nicifos II which would yield the maximum profit.

Summary and conclusion.—1. The note briefly deals with the response of wheat varieties to the application of nitrogenous fertilisers under Haveli System of cultivation. The experiment was of a split-plot design. The experimental error on the sub-block basis was 8.05 and on plot basis 6. 79 per cent.

2. Wheat A.0.90 gave the highest yield of 738 lbs. per acre followed by P. 52 which yielded 711 lbs. while P. 4 gave the lowest yield of 613 lbs. per acre.

3. Both ammonium sulphate and Nicifos II, drilled with seed gave significantly higher yields compared to no. manure plot, the yields secured by the application of Nicifos II being significantly higher than those secured by the application of ammonium sulphate.

4. Inter-action of varieties with treatments is significant. A 115 appears to respond best to the application of Nicifos II and P. 52 the least.

5. Application of Nicifos II at 15 lbs. of nitrogen per acre was done at a profit of Rs. 1-6-0 per acre while that of ammonium sulphate was done at a loss of Rs. 0-9-8 per acre at the present rates of wheat and fertilisers.

6. The resume of earlier experiments show that application of Nicifos II at the rate of 20 and 30 lbs. of nitrogen gave significantly higher yields but they were secured at a loss because of the extra cost of the fertiliser.

Our thanks are due to Mr. Yarmahommad, Farm Superintendent, Adhartal, for helping in conducting this experiment.

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APPENDIX

KHERI FARM—WHEAT VARIETAL AND MANURIAL 1938—39

Yield of grain in lbs. per plot of 1/40th acre.

Variety.	Treatment.	Replications.				
		1	2	3	4	5
A.O.90	Nicifos II. ...	25	20	24	22	21
	Ammonium sulphate...	19	20	19	16	17
	No. manure ...	85	15	16	14	14
A. 115	Nicifos II ...	24	23	24	22	21
	Ammonium sulphate...	17	18	21	13	16
	No. manure ...	13	12.	15	12	12
P. 4	Nicifos II ...	22	21	18	18	17
	Ammonium sulphate...	15 5	16	14.5	14	14
	No. manure ...	13	12	14	11	10
P. 52	Nicifos II ...	24	22.5	19.5	19	19
	Ammonium sulphate ..	20	19	15	14.9	17
	No. manure ...	16.5	15.5	16	15	14
P. 101	Nicifos II ...	22	20	22	19	20
	Ammonium sulphate...	18	18	20	17	16
	No. manure ...	14	12	14	12	12

MYSORE COTTONS AND THEIR IMPROVEMENT

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Although India is second largest cotton growing country in the world, the major portion of the crop develops short and coarse staple. So the subject of developing stapled cottons in India has engaged the attention of the Government for over a century.

Several attempts in the past have been made to establish staple American Cottons—Mr. J. Mackenna in India in a lecture to the Students of Sydenham College of Commerce, Bombay has traced the introduction and development of American Cotton in India. The net result of the attempts made for over a century was the establishment of the American Cotton in Dharwar.

However this acclimatised cotton has a serious drawback in that it usually develops a leaf disease by which the leaves redden and drop off, though under certain conditions they recover, with the consequence the yield and quality of cotton are very much lowered.

From a study of the Minutes of evidence submitted to the Indian Central Cotton Committee by Agricultural officers and men interested in cotton growing and trade, the introduction of recently developed American Cottons fared no better.

In recent years a short stapled, inferior variety locally called ' Bokda " which botanically is a type of G. Neglectum is being introduced extensively into the Mysore cotton tract, which has all along been stapled cotton area, on account of its high yield and ginning. This is being grown in red soils with the help of irrigation. This cotton is being used for mixing with some of our superior cottons. The Government have decided to introduce legislation to prevent growing this variety. So the second object of this work was to develop a strain through hybridisation giving as high a yield and ginning outturn as the local neglectum but producing a superior staple.

In the past, two theories have been put forward for the cause of the " Red Leaf Disease," on the basis of which the cotton-breeder hoped to develop a disease-resistant variety. The first of these was that the oppearance of the disease in American Cottons might be due to the

CERNUM × NADAM

different method of root system from that of Desi Cottons, which do not generally develop this disease; while the growth of the main top-root in American Cottons is arrested in its early stage and the secondary and other roots rapidly grow and form surface feeder, in Desi Cottons, on the other hand, the main root develops into deep tap-root.

With a view to develop a strain of American Cotton with a deep tap-root system as in Desi, a cross was made between a tree cotton belonging to the New World Group (G. Peruvianum) with one of our local American selections. Although we got out of this cross some superior strains such as M.A. II, M.A. IV, 204—208 and etc., still from the point of disease resistance, this work was a failure as the strains developed " Leaf Blight " as badly as any of the local Americans.

The second theory suggested in connection with the development of this disease was the association of resistance to the disease with the hairiness of the plant. In other words, the plants that are hairy, resisted the disease to a greater extent than the glabrous ones. On this basis, Rao Saheb Kottur of Bombay Agricultural Department developed a hairy type called Gadag I, which claimed to resist the disease. But in our experience, Gadag I gets the disease as badly an any other variety.

In recent years a very systematic and intensive study on this disease has been made at the Institute of Plant Industry, Indore, by Messrs Madusudana Rao and Wad (3) who have come to the conclusion that " the disease may develop under different atmospheric environments provided the soil surface becomes puddled after prolonged saturation and that a practical solution lies in increasing the resistance of the soil to long continued saturation with its deleterious effects which resistance must be maintained sufficiently strong till the end of the crop season. Thus the line of fruitful research in the future, they suggest, appears to be to find out for each locality a suitable method of soil fertilizing (in the widest sense of the term) so that its resistance may be maintained." From the above it will be seen that the chances of getting a resistant strain from a breeder's point of view are very remote, if not impossible.

Since exotic cottons are generally cultivated either as rain-fed or as irrigated crop in red soils and these possess big fruits (bigger than Desi), high ginning, long and silky staple suitable for spinning 30s and over warp counts, it struck the writer to ascertain whether it is at all possible to develop a variety through hybridization amongst Desi Cottons,

possessing all qualities of American and at the same time, suitable for red soils. If such a thing was possible the question of developing a Blight-resistant variety is easily solved since Desi Cottons, as previously stated, do not generally get this disease.

As is well known, the fruits of Desi Cottons are small (small Kappas) as opposed to the big fruits usually developed by American Cottons. However, there is one variety of cotton in the old world (Desi) Group which develops as big a fruit as any American variety and at the same time possesses a high ginning out-turn, though unfortunately, its fibre is very coarse and poor. This is G. Cernuum, or locally known as Garo Hill or Wool-Cotton.

An attempt was made to hybridize this cotton with one of our local varieties with a view to develop a strain possessing all the qualities of American Cottons.

Previous attempts made to hybridize G. Cernuum with other Desi Cottons.—Sir George Watt (4) mentions of the attempt made by Major Trevour Clark somewhere near 1870 in crossing Assam Hill Cotton with Hinganghat. Again a mention is made by him of a Mr. Collen who re-performed Major Clark's hybridisation work. It is presumed that the survival of his (Mr. Collen) work is the so-called acclimatized Kil-Cotton developed in Nagpur. In the recent years two attempts have been made to hybridize G. Cernuum with Desi varieties. The first of them is by Rao Saheb Prayag (5) of the Bombay Agricultural Department, who by crossing Comilla with Bani developed a strain called Banilla and this is being grown on a fairly large scale round about Khandesh, replacing the local Neglectum. But we have not been able to ascertain whether the fruits of Banilla are as big as those of Cernuum. As regards the quality (length and feel) in the new variety, it seems there is no pronounced improvement since it measures 5/8" to 3/8" though superior to Neglectum (which measures about half an inch). Also Banilla spins not more than 20s counts and thus does not come under the definition of long staple. The second attempt made to hybridize G. Cernuum with a superior indigenous variety was made by Mahomed Afzal (6) at Trinidad. He crossed G. Cernuum with Burma Silky Cotton G. Indicum (Herbaceum) and studied the factors on leaf, flower, boll, lint and seed characters. He was not able to recover the big long type of fruits of Cernuum in F-2 and

later generations, though he developed long staple and with high ginning percentage.

Method of work.—A cross was made in Mysore in the year 1927—28, using G. Cernuum as one of the parents with a local variety called Nadam answering to G. Obtusifolium. This is stated by Watt to be a close relative to Bani Cotton (G. Indicum) (7). The plants in F. 1 generation developed deep lacinated leaves and almost the big sized fruits of G. Cernuum. Plant selections were started in F.2 and later generations based on the branching habit, the size of the fruit (big fruits) possessing long fine staple and high ginning out-turn. After seven years of conscious selection we have in our possession two strains N x C 86 and N x C 4—5 which are highly promising. The first of them viz. N x C 86 has proved to be suitable to replace American Cottons and the other (4—5 strain) to replace the Neglectum. From a study of the branching habit it is felt that selection of plants developing many vegetative branches will produce high yielding strains as the production of tertiary fruiting branches in the secondary vegetative branches is almost at the same time as the development of the secondary fruiting branches on the main stem. This observation is quite in contract to what happens generally in the types of G. Herbaceum in which the terrtiary fruiting branches develop after a very long time and for this reason, in such varieties erect plants, i. e. plants having few vegetative branches but greater number of fruiting branches, to ensure early crop are isolated.

One of the features of the above two strains is that they develop bracts bigger than those of any Desi Cottons though they are not as big as the Cernuum proper. Dr. Kearney (8) in one of his recent papers has discussed the advantage and the drawback of the presence of the three bracted involucre which subtends the flower in all species of Gossypium. He concludes that "the involucre plays an important part in the development of the flower and boll." The results of his experiments point that "suppression of this organ on plants of Pima Cotton at the time of anthesis caused a marked reduction in the size and weight of the boll, in the weight of the seeds and in the abundance of lint." His observation further pointed out that...........the involucre 12 days before anthesis equally had the weakening tendency in addition to a reduction in the number of seeds in the boll due to the under nutrition. On the other hand, the presence of the involucre contributes to a loss in cotton production, since the bracts which invests the boll rather closely become very dry and brittle by harvest time, as "it is almost impossible to pick

the seed cotton from the open bolls without getting fragments of bracts entangled with the mass of lint hairs."

Since "cotton is sold on grades based largely on the proportion of foreign material or trash present and the small pieces of bracts, are the largest elements of the trash "the price received by the grower naturally diminishes."

One of the chief complaints generally against the Indian Cotton is that it is dirty, mixed with dried leaves and bracts and thus not appreciated in mills. It will be remembered that a suggestion was made by the Indian Central Cotton Committee whether it would be economical to influence the cotton growers to do clean picking. The result of the enquiry was that it was not a practical proposition. Mr. Milne has pointed out in his evidence to the Cotton Committee (9) that in the Garo Hill Assam Cotton, the Kappas hangs out of the bolls in such large masses that it would be harvested with a minimum of trouble and with little or no leaf or dirt in it.

Sir George Watt (10) also makes a reference to this cotton in this regard. He says, "the pods are very large, sometimes as much as 8" in length and when they burst the contents come out in a cataract of cotton which gives a field the appearance of being covered with snow. In two strains we have developed, the fruits resemble those of Cernuum and thus clean and easy picking is made available, and also, as stated above, the matured cotton hangs down, the chances of it being mixed with dried bracts and leaves are avoided.

So by developing a variety of cotton possessing big bracts and fruits with the seed cotton going down as in the new strains we have the advantage of the involucre functioning as a nutritive medium to the plant and at the same time permitting clean and easy picking.

The fibre test of one of the strains (C x N 86) is made available both by the Technological Laboratory and the Binny Mills which are enclosed to this note. It is hoped to publish a more detailed paper on this work in the near future.

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INDIAN CENTRAL COTTON COMMITTEE, TECHNOLOGICAL LABORATORY

Fibre Test Report No. 115.—On a sample of C x N. 86 cotton received from the Senior Assistant Botanist, Government Experimental Farm, Hiriyur.

Sample No x 696 **Cotton C x N. 86** **Season 1934-35**

1. FIBRE TEST RESULTS

1. Fibre-length Distribution (Balls Sorter) :—

Mean group-length in eights of an inch.	Percentage.
2	0.3
3	0.6
4	1.7
5	3.2
6	11.0
7	33.0
8	32.8
9	13.9
10	3.5

2. Fibre length (inch):—(*a*) By Balls Sorter 0.93; (*b*) By Baer Sorter 0.94; 3. Fibre weight per inch. (millionths of the ounce) 0.206; 4. Fibre strength (oz) 0.241; 5. Intrinsic strength 1.17.

2. **Remarks.**—This cotton is rather coarse for its length, but its intrinsic strength is high. It is nearly twice as high as that of H. 190, is higher than that of Hagari and Combodia, though not so high as that of Nandyal 14. From its fibre-properties it is estimated that this cotton is likely to spin up to 32's standard warp counts.

SPINNING TEST BY BINNY MILLS

	Strain N. C. 86.
Contract valued under	Broach July/August
Class	Barley Fine
Colour	Brownish
Feel	...
Staple length	11/16″
Staple length	Good
Regularity	Regular
Value above or below contract rate	Rs. 15/- on
Basis	Rs. 151
Date of valuation	25-6-38

OUR TOUR TO THE BETUL FARM

By K. S. Krishna Rao

(3rd Year Class, Agri. College, Nagpur).

We visited the Seed and Demonstration Farm at Betul to study the cultivation of the sugar-cane crop in detail.

The area of the Farm is 160 acres out of which the cultivated area is 145 acres, the rest being occupied by roads and bunds etc. The money crops of the tract are sugar-cane and wheat. The Farm has got four pucca wells each provided with a rahat. We were told that the capacity of a rahat with ½ gallon buckets was equivalent to an ordinary mhote. 15 acres of land are put under each well and the crops rotated alternately. The rotation practised is only a two-course rotation with sugar-cane and wheat. The area under each well is divided into three blocks. In one block cane will be under harvest this year. In the second they will plant cane this year and in the third a crop of wheat will be taken.

The other crops of the Farm are Chillies, Garlic, Linseed, Onions, Peas and Gram. The Farm also maintains an orchard of three acres. One acre of this is alloted to the Students' Garden of the students of the Anglo-Hindi Middle School. In the second acre they have planted Mosambi and Grape-fruits. Papaya is planted in the third acre for the purpose of extraction of the milk or latex of the fruitcoat to be made into Papain, a product rich in the enzyme Pepsin. The Farm also conducts experiments on the different seed-rates for wheat. The three alternatives are 60, 80 and 100 lbs. per acre respectively. The crop with the seed-rate of 60 lbs. gives a better crop than the rest due to delay in maturity by at least a fortnight.

Basal tillage and manuring for Sugar-cane.—The crop requires about 150. lbs. of Nitrogen for its successful growth in the C. P. The soil of the Betul Farm is a Second Grade Morand. The system of manuring followed on the Farm is the most economical and is also quite effective. The nitrogen is supplied in three instalments as follows:—

1. 50 lbs. by green-manuring, (2) 50 lbs. at the time of planting, (3) 50 lbs. at the time of earthing.

For green-manuring 80—100 lbs. of seeds of Sann Hemp are broadcast per acre, in the beginning of the rains along with other kharif crops. It is allowed to grow for 7—8 weeks when it is ploughed in with a Sabul Plough. The best period is near about 50 days so as to get maximum of dry matter without fibrous development. The field is then left undisturbed till all the stuff has decomposed completely till November when a bakharing is given. This bakharing is followed by three ploughings, two with the Monsoon Plough and one with the Sabul Plough.

Lay out and Planting.—The land thus perpared is laid out into ridges and furrows with the E. T. 2 Plough. Cultivators who cannot afford its high price use the Bihar Ridging Plough costing Rs. 10/- and capable of preparing the ridges 2 feet apart. The furrows are mended into Kyaries or into long furrows according to the method of irrigation to be followed. At this time, before planting the second dose of manure is given. This consists of a mixture of 10 mds. of Karanji cake and 100 lbs. Nicifos II.

The cane to be planted is brought to the field and the stripping done carefully by hand. The cane is then cut into sets each containing three healthy buds. The sets after being cut are examined for the presence of red-rot and such sets as are diseased are rejected for planting. The method of planting followed on the Farm is to place the sets horizontally giving all the buds an equal chance of germinating. Some cultivators

simply drop the sets in the furrows and trample over them to secure burying. This injures the eyes and some do not germinate at all thus creating an un-equal stand of the crop in the field. One irrigation is given as soon as the cane has been planted. This is given on the lighter soils before planting the sets so as to facilitate in pushing the set into the soil. This cannot be practised in the heavier soils for fear of spoiling the tilth.

After-care.—The buds germinate in about three or four weeks after planting. They are irrigated with sufficient water throughout the summer. In the beginning of the rains the crop is given the third manurial dose. A mixture of 10 maunds Karanji cake and 100 lbs. Nicifos II is applied and the crop is earthed up. The crop does not receive any irrigation during the rains but after the rains it is irrigated with a lesser frequency than before the rains. As the cane grows up and needs support, the older dead leaves are used to tie a number of canes into one group. This supports the cane against wind etc. No other care is taken till the harvest except giving weedings during the rains and also after this to remove the parasitic weed 'Agia.'

Gur-making.—The process of Gur-making followed on the Farm is as follows. Juice from the mill after being filtered is transferred to the pan and evaporated till the stage for Gur-making is reached. During this process all the scum that rises to the surface is removed by perforated ladles. Later on, the juice of the wild bhindi plant is added as a clarifier and the scum produced is also removed. When the juice reaches the temperature of 118°C it is brought down from the furnace. This stage is detected by the Gur-makers by inserting their moist hand into the boiling stuff and making a small ball of the juice thus removed by plunging the hand instantly into a basin of water. If this ball is hard enough to re-bound from a hard surface like the side of the pan, it indicates that the juice is ready for being brought down from the furnace for Gur-making. The Gur when thus ready is poured into wooden sinks and allowed to cool. When it becomes cool and solidified it is transferred to square pieces of cloth with their ends tied together so as to hold one maund each. The bags are suspended from a beam with plates placed below them. The non crystallizable part of the Gur trickles out as a jelly and collects in the dishes placed below. This sticky jelly-like substance is known as the mollasses and is the bye-product, for the utilization of which many means are being discovered. On the Betul Farm it is sold as an inferior Gur to the poorer class of the people. The Gur after draining of the molasses becomes superior in quality and commands a higher price.

Sugar-cane Crushing Mills.—There are two mills on the Farm. One of these is driven by bullocks and the other is power driven. The bullock-mill is the Kirloskar Brothers' Karamat Mill and the machine driven crusher is also by the Kirloskars, but it is the 'Sharat' type.

The bullock-driven mills consists of three vertical rollers put in gear by teeth. There are two indentical rollers which are less corrugated than third one which is smaller in size than the previous two. All the three rollers are enclosed in a casing of cast iron which has a spout for the delivery of the juice and an opening near the more corrugated roller for the feeding of canes. The bullock-power is applied at the ends of a horizontal pole fixed into the axis of one of the big rollers. The mill is capable of being worked by only one pair but usually two pairs are employed because the outturn per hour is more than double that obtained by using only one pair.

It is usually expected to crush 300 lbs. of cane per hour. When 50 lbs. of Co 219 were crushed the mill took 6 minutes and gave 36 lbs. of juice. Thus the extraction percentage with a soft cane like the one used works out to 72%. When hard canes like Co 313 are put into this mill the out-turn does not fall but the extraction percentage gets considerably redueed. In this case when 50 lbs. were crushed, the time taken was the same but the amount of juice obtained reduced to 31.5 lbs. only. The extraction percentage thus works out to only 61%.

The power-driven mill is the 1933 model of the Kirloskar Brothers' Sharat type. Its price is Rs. 475/- Its requires 7—8 b.h.p. to drive this crusher. The mill consists of two horizontal rollers placed at a close distance and with their surfaces roughened to get a good grip of the cane fed into them from the feeding board. The r. p. m. of the rollers is reduced by suitable gearing from the pulley so as to sqeeze the cane fully. The whole is fixed on a solid foundation and connected to the engine by means of a belt. On the Farm this crusher is driven by a Crossley Crude Oil Engine capable of developing 8 h. p. whose consumption is as follows:—If it is worked for 1½ hours it consums 5 lbs. of Crudo Oil at 10 annas, per gallon and one lb. of Mobil Oil at 12 annas per gallon. The price of the engine is Rs. 1100/-.

The out-put of this mill decreases as the cane crushed gets harder. The usual out-put is about 1500 lbs. of cane per hour. When Co 219 was tried, we crushed 200 lbs. and the machine took 8 minutes to do this. At this rate the capacity of the mill works out to 1500 lbs. per hour. In this case we got 133 lbs. of juico giving an extraction percentage of

66.5%. When a hard cane like Co 313 is crushed, it took 5 minutes to crush 100 lbs. and gave 62 lbs. juice. Due to the hardness of the cane both the out-put and the extraction percentage fell to 1,200 lbs. per hour and 62% respectively.

Pans.—There are two pans on the Betul Farm. Both are shallow pans and their dimensions are as follows:—

Dimension	Pan No. 1	Pan No. 2
Top diameter ...	6' 7"	7' 5"
Bottom diameter ...	5' 8"	6' 5"
Depth ...	1'.	1' 2"

Each pan is provided with four stout iron rings for passing poles through when it is necessary to move the pan either to or from the furnace in the process of Gur-making.

Furnaces.—Each pan is provided with one furnace of the Sindewahi type. They are not the typical originally invented ones but are slightly modified in two ways. The first is the shifting of the dwarf-wall from the centre of the furnace-pit to the side of the flue. This ensures better distribution of the flames. The other slight modification is the extension of the grating a little distance along the furnace pit. This is known as the Bottom-Grating.

The following are the measurements of the furnace for the first pan given above.

Inside diameter at the top 6 ft. ... Inside diameter at the bottom 4 ft. 8 inches; Length of the Dwarf-wall 3 ft. 4 inches; Height of the Dwarf-wall 1 ft. 3 inches; Length of the Side-grating 1 ft. 8 inches; Breadth of the Side-grating 1 ft. 4 inches; Length of the Bottom-grating; 1 ft. 8 inches; Breadth of the Bottom-grating 1 ft. 4 inches.

Both these furnaces are provided with sufficently tall chimneys to produce a good draft of air thus ensuring better burning of the fuel inside. When the pan was charged with the juice from the mill they put 1092 lbs. of juice (26 kerosene tins of capacity of 42 lbs. each) For the evaporation of this quantity juice they needed 330 lbs. of megasse. The dried megasse obtained from the cane from which 1092 lbs. of juice were obtained amounts to 504 lbs. while the furnace consumes only 330 lbs. Thus this form of the furnace leaves a surplus of the megasse which may be used for the manufacture of Synthetic Farm-Yard-Manure or any other purpose.

Wooden Sinks.—Each pan is provided with a separate wooden sink to transfer its contents when the Gur is ready so that the pan may take a fresh charge. The Gur is allowed to get cool and solidify in the wooden sinks before it is put into the cloth-bags for the purpose of draining the glucose. Both the sinks are of the same dimensions as follows:—

Length 5 ft. 10 inches; Breadth 3 ft. 10 inches; Depth 5 inches.

Extraction Percentage Experiments and the use of the Sachharimeter.—The Sachharimeter kept on the Farm is the Brix manufactured by Baird and Tatlock, Ltd.. London. It resembles the Lactometer in design but is a bit larger and has got a longer stem on which the readings are taken. In the stem is fixed a graduated scroll of paper with graduations from 0 to 32, the zero being on the top side. The standard temperature at which the readings are to be taken is 65°F. The reading obtained on the Sachharimeter indicates the sp. gr. of the liquid which increases as the soluble matter in the liquid increases. The reading of the juice of any cane increases as it gets nearer to maturity with regard to harvest and this is seen by the increase of the reading of the Sachharimeter. Thus when the maximum for any variety is attained it indicates that the particular cane is ready for harvest. The following are the precautions in using a Sachharimeter:—

(*a*) The cylinder holding the juice must be deep and wide enough to prevent the Sachharimeter from touching the sides.

(*b*) The juice must not contain air-bubles which tend to make the Sachharimeter float and thus tend to reduce the reading. Hence the juice to be tested must be poured slowly into the cylinder and all the air-bubles must be allowed to rise to the surface before inserting the Sachharimeter for taking the reading.

The following are the results of the various experiments we performed with various canes with regard to their densities of the juice of the cane as a whole and that of the different portions of the cane.

TABLE 1

Portion of the cane.	Weight lbs.	Juice obtained.	Extraction percentage.	Brix Reading.
		Co 210		
Top	21	11	52.4%	18.0
Middle	32	20	62.0%	18.5
Bottom	57	29	62.0%	19.0
Average density of the juice of the whole cane	...	...	...	18.5

E. K. 28

Top	23½	15½	64.0%	19.5
Middle	31	20½	66.0%	20.0
Bottom	45	30	66.6%	20 5
Average density of the juice of the whole cane	...	...	...	20.0

TABLE 2

Variety of cane.	Brix Readings.			
	Whole cane	Top.	Middle.	Bottom.
P. O. J.	21.5	21.5	21.5	22.0
Co 219	18.5	17.5	18.5	19.5
Co 313	20.5	...	...	...

VARIETIES OF SUGAR-CANE GROWN OF THE FARM

Co. 210 is distinctively red in colour with yellow stains on the botton nodes. It is not a straight cane and always grows zig zag. It is the earliest of all the Coimbatore canes and matures by the beginning of November and gives 112 maunds Gur per acre.

Co. 219 is the latest of all Coimbatore canes. It was formerly very popular. It is a straight cane and has black stains over the stem. Its defect is that it is not red-rot-resistant. The quality of the Gur when attacked by red-rot is very bad. It matures by the beginning of February.

Co. 312 constitutes one of the standard varieties of the Farm. It is on the yellowish side in colour. It is thinner than Co. 313 in a sample of many canes which it otherwise resembles. There are black stains on this cane also. This cane becomes a little reddish at the bottom when it becomes ripe. It matures by the end of November and yields about 145 maunds of Gur per acre. The hardness of this cane is medium.

Co. 313 is thicker than Co 312 in a sample of many canes but there are great variations in this also. It is the other standard variety of the Farm. It is also a straight cane and is slightly greener in colour when compared with Co 312. It has also black stains on the stem. The cane becomes little reddish at the bottom when ready for harvest. Another quality of this cane is that it is late in germinating and requires stoppage of irrigation for this purpose. It matures in December and yields 158 maunds of Gur per acre. The hardness of this cane is medium.

P. O. J. is an imported cane from Java and signifies 'Pride of Java.' It is greenish red in colour and is decisively thicker than either

Co 312 or Co 313. It is also a flowering cane and is a little later than Co 313. It matures by the beginning of January. The inter-nodes of this cane are very short. This cane is the softest of all and gives only 97 maunds of Gur per acre.

E. K. 28 or a Nabi Baksh cane introduced from the U. P. It has also got short inter-nodes and is reddish yellow in colour. It is a clean cane and has no stains on the stem. It is the latest of all canes on the Farm and matures by the end of January. The cane is a soft one but when compared with P. O. J. it is a bit harder. It yields 102 maunds of per acre.

ECONOMICS OF A FEW CULTIVATORS NEAR BETUL

The Chicklia Farm.—We learnt from the manager of this estate that the whole of his estate is divided into four portions and that the portion we had visited was named the Chicklia Farm. The areas and the cropping schemes of these are as follows: (figures are in acres.)

Name of Estate.	Area in acres.	Sugar-cane.		Wheat.	Grass.	Others.
		Planted.	Ratoon.			
Chicklia	90	4	2	64	10	8
Malaichpur	20	...	...	2	3	18
Sohagpur	4	...	...	...	2	4
Arool	85	...	...	40	13	45

The grass-land is included in the area of the farm on the Chicklia farm but on others it is a separate area. There are 18 pairs of bullocks on the whole estate. The annual expenditure of the Chicklia Farm amounts to Rs. 900/-. The number of servants on the whole estate is 9 and each is paid at Rs. 5/- per mensem.

Mr. Kashiram, the manager of the estate takes ratoon crop of sugar-cane. The yield of the sugar-cane from the ratoon crop is 29 maunds of Gur per acre. But it is paying to take the ratoon crop because of the smaller expenditure incurred in raising the crop. All the leaves and the trash in the field is burnt in the furrows. Nextly the land is irrigated at an interval of a fortnight. He does not irrigate the crop during the summer after this due to dearth of water. During the rains the crop receives 160 lbs. of Nicifos II costing Rs. 13/6/-. The inter-cultivation is done by using the country plough and that too only once. If however he manages to irrigate his ratoon he gets 42 maunds of Gur per acre. The ratoon crop is not paying in the third year of planting because the yield

falls as low as 6—10 maunds of Gur. The planted crop is irrigated as follows :—

December to March 8 days; March to June 12 days; from end of rains to harvest—no irrigation.

We learnt from the manager that following is the expenditure on the cultivation of sugar-cane for a total area of four acres.

Pundrette Rs. 60/-; Sann Hemp Seeds Rs. 13/-; Farm Yard Manure Rs. 40/-; 6 bags of Nicifos II, Rs. 40/2/-.

The total annual permanent expenses on the Farm amount to Rs. 830/-. This includes the pay of the nine servants at Rs. 5/- each and also the land revenue of Rs. 148/- along with the feeding charges of the four pairs of bullocks on the Chicklia Farm. The manager told us that he does not employ any variable labour on the Farm.

The income of the Chicklia farm is as follows :—

Gur	...	12,000	0	0
Wheat	...	800	0	0
Miscellaneous	...	400	0	0
Total annual income	...	2,400	0	0
Total annual expenditure	...	900	0	0
Net profit per year	...	1,3C0	0	0
Net profit per acre	...	14	7	0
Net profit per month	...	108	4	0

THE BETUL BAZAR FARM

This was the second farm we visited. The area of the farm is 160 acres and the cropping scheme is an follows :—

Sugar-cane (planted)	5 acres
Sugar-cane (ratoon)	8 „
Wheat	100 „
Pasture for grazing	20 „
Miscellaneous	32 „
	160 acres

There are 10 permanent servants on the estate. These are paid at the same rate as the previous malguzar. In addition to this he employs variable labour when there is pressure of work. The charges for this variable labour amount to Rs. 100/- There are 18 pairs of bullocks on the estate. The owner, Mr. Kanhia Lal also takes a ratoon crop just as the previous manager. The following are the items of annual income of the farm.

Gur ...	1,600	0	0
Wheat ...	2,000	0	0
Total annual income ...	3,600	0	0

The following are the annual charges of the estate as given by the malguzar himself.

Permanent labour ...	600	0	0
Variable labour ...	100	0	0
Land Revenue ...	500	0	0
8 bags of Nicifos II ...	53	8	0
Depreciation on bullocks ...	65	0	0
Total annual charges ...	1,318	8	0
Total annual income ...	3,600	0	0
Total annual charges ...	1,418	8	0
Net profit per year ...	2,181	8	0
Net profit per acre ...	13	10	0
Net profit per month ...	181	9	8

FARM OF Mr. RAM NARAYAN VERMA

The area of this farm is 28 acres and the cropping scheme is as follows :—

Sugar-cane	4 acres
Wheat and other rabi crops	24 acres
	28 acres

There are 8 pairs of bullocks on the estate and three permanent labourers paid at Rs. 5/- p.m. only. The following figures give the cost of Gur-making on this farm.

5 men for stripping cane ...	0	15	0
1 man for cutting cane ...	0	3	0
2 men for Gur-making ...	0	6	0
5 men for crushing ...	0	15	0
8 pairs of bullocks ...	4	0	0
Hire of pan, oil and other sundries ...	2	1	0
Total daily charges ...	8	0	0
Cost of Gur-making per maund when daily 10 maunds are turned out ...	0	13	6

The following are the sources of income of the farm. He obtains 350 maunds of Gur from the four acres of planted cane :—

Gur	...	2,025	0	0
Wheat	...	180	0	0
Total annual income		2,205	0	0
Total annual charges		1,200	0	0
Net profit per year	...	1,005	0	0
Net profit per acre	...	35	12	0
Net profit per month	...	83	12	0

SUGAR-MAKING ON THE GOVT. FARM, BETUL

We were also given a small demonstration of sugar-making by the Open Pan Method. For this purpose the juice while being boiled is removed from the furnace before it is ready for Gur-making at a stage, known as the Thin Rab Stage, which is nearabout 114°C. Rab thus removed is set aside for crystallization. At the end of a time shown by the following table the sucrose crystallizes out and remains in a jelly of the non-crystallizable glucose :—

Temperature of keeping the rab. Fahreinheit.	Time taken for the crystallization.
106°	2 weeks
110°	1 week
112°	24 hours

A charge of about 3—4 lbs. of this mixture is put into the Sugar Centrifuge and submitted to the action of Centrifugal force., whereby the non-crystalline glucose passes through and is collected as the mollasses. whole charge is then washed twice or thrice with a 1% solution of Stannous Chloride. The Centrifuge costs Rs. 500/- and it requires a 3 h. p. engine to drive it.

COST OF CULTIVATION OF SUGAR-CANE ON THE BETUL SEED AND DEMONSTRATION FARM

Note :—The following are the daily rates for the various types of labour employed on the Farm.

One man 3 as. per day. One pair of bullocks 0 8 0 One woman 2 as. per day.

1. Land-Revenue	...	3	0	0

2.	Green-manuring		4 10 0
	(a) Cost of 100 lbs. of seed at Rs. 1/8/- per maund, including sowing Rs. 2/6/-		
	(b) Burying Sann Hemp, 1 monsoon plough for 3 days. Rs. 2/4/-		
3.	Bakharing in September		0 12 0
4.	Two monsoon ploughings for 2 days each in October		1 8 0
5.	One Sabul Ploughing with one pair and one man		2 13 0
6.	Ridging. One man and one pair doing one acre per day		0 15 0
7.	Manuring		18 5 0
	(a) Nicofos II	8 1 0	
	(b) Cake	10 0 0	
	(c) Spreading the above. Two woman	0 4 0	
8.	Cost of seed-cane (3000 canes at Rs. 1/4/- per 100)		37 8 0
9.	Making sets and stripping cane		1 13 3
	(a) stripping at Rs. 3/9/- per 1000	0 11 3	
	(b) 2 men for three days to cut sets	1 2 0	
10.	Planting		3 12 0
	(a) 2 men for 2 days for irrigating	0 12 0	
	(b) 6 women for spreading the sets for two days	1 8 0	
	(c) 1 Pair working the rahat	1 8 0	
11.	Top-dressing with 100 lbs. Nicifos II in March		8 5 0
	(a) Cost of 10 lbs. Nicofos II	8 1 0	
	(b) Spreading. 2 women for one day	0 4 0	
12.	Hoeings		3 12 0
	4 hoeings with one pair of bullocks and one man doing 1 acre per day.		
13.	Irrigation charges		42 0 0
	There will be 17 irrigations		
14.	Top-dressing at earthing time		11 3 0
	(a) 10 maunds of cake	10 0 0	
	(b) 2 women to spread	0 4 0	
	(c) Ridging (earthing)	0 15 0	
15.	Tying canes. 12 men for one day		2 4 0
16.	Harvesting charges. 1 man for 8 days for a crop of 800 maunds of cane		1 8 0
	Total cost of cultivation		144 0 3

Cost of 40,000 canes at Re. 1 per 100	...	400	0	0
Cost of cultivation	...	144	0	3
Net profit per acre	...	255	15	9

COST OF GUR-MAKING ON THE BETUL FARM

Daily Charges:

1. Harvesting and stripping the cane 1 man for cutting the cane and 8 women for stripping				...	1	11	0
2. Carting, taking 2 men and two pairs				...	1	6	0
3. Crushing				...	1	7	0
1 Engine-man at 8 as. per day							
5 men at 3 as. per day							
4. Gur-making				...	1	0	0
(a) 4 men at 3 as per day	0	12	0				
(b) 2 women at 2 as. per day	0	4	0				
5. Fuel charges for the Engine				...	4	4	0
(a) 4 bottles of Mobil Oil							
(b) 3½ gallons of Crude Oil							
6. Depreciation on Crusher and Engine costing	1000	0	0	...	2	0	0
Total daily charges				...	11	12	0

For the above expenses 20—21 maunds of Gur are turned out per day. Thus the cost of Gur-making with the prevalent power-crushing amounts to about 8 as. per maund. But when crushing is done by bullock power the cost rises to 12—13 as. as seen in the case of one of the cultivators.

Amount recovered by sale of 80 maunds of Gur, taking this to be the average yield	...	440	0	0
Cost of Gur-making including the cost of cultivation of the crop	...	184	0	0
Net profit per acre by Gur-making	...	256	0	0

COST OF CULTIVATION OF WHEAT ON THE BETUL SEED AND DEMONSTRATION FARM

1. Land Revenue ...	2	0	0
2. Manuring, 10 C. L. of F. Y. M. at 8 as. per cart-load	5	0	0
3. Ploughing once with the Monsoon plough before end of August 1 pair and 1 man for 2 days ...	1	8	0
4. 3 bakharings, 1 pair and 1 man doing 2 acres per day	1	2	0
5. Sowing ...	3	8	0
(a) 80 lbs. seed at 30 lbs. per rupees			
(b) Sowing with Nari Plough taking one pair and one man			
6. Irrigation charges ...	3	0	0
There will be only one irrigation.			
7. Harvesting at 10 as. per acre ...	0	10	0
8. Threshing, 1 pair for 2 days ...	1	8	0
9. Winnowing ...	0	8	0
Total cost of cultivation ...	18	12	0
Amount realized by sale of 1,000 lbs. of wheat from the irrigated crop at 32 lbs. per rupee ...	31	4	0
Cost of cultivation ...	18	12	0
Net profit per acre ...	12	8	0

Importance of the Papaya Plant.—The dried latex of the fruits is called Papain and commands a great commercial value of Rs. 8/- per lb. The process of extraction and the details, are given in Agriculture and Livestock in India Vol. II, Part V September, 1932. It is a very profitable industry and is calculated to give a net profit of Rs. 21,000/- in three years from a plantation of 20 acres.

Extracts

MADHUBINDU PAPAYA PLANTATION

BY MR. RAMJI HANSRAJ

(Chairman, Kathiawar Village Reconstruction Committee.)

As a practical experiment in agriculture, or rather horticulture, in so far as some fruit trees are concerned, I started the Rambag Plantation three years ago. After ascertaining what fruit trees would be suitable to the climate and soil of this particular place, we began to grow fruit plants and trees, such as the mango, grape, orange, the Allahabad and Benares jamfalli and pears and cocoanuts, etc. In order that these fruit plants and trees might be properly reared and the expense thereof be met with, the side-plantation of Bisrai Banana, Lotan Banana, Elaichi Banana, Country Banana, Golden Banana, Madhubindu Papaya etc., was taken in hand.

Up till then, the Washington Papaya was very famous and everybody advised us to plant this type. I started my experiment with many types of papaya seeds, and within a year, I found one other variety, the best, which we now call "Madhubindu." Its sweetness, bulk and yield are extra-ordinarily satisfactory. I have found its plantation economic and paying; so I beg to place my experiment of the same before the public.

Only three months after planting this type, we found that flowers appeared on the plants and within six months the plants were full of flowers, right from the stalk just above the ground. The growth of these plants was more rapid than that of other kinds of papaya, and the abundance and the length of the leaves were greater than those of other kinds. The flowers were also more abundant than can be found on other types and what drew our particular attention was this that the number of male papaya trees was comparatively small. On other kinds of papaya it is found that the number of male trees are 50 per cent of total.

We were very much pleased to see this result and we decided that the plantation of this type should be made on a large scale so that seeds of this type can be made available to people in large quantities.

Only nine months had elapsed when the fruits on these 100 plants began to ripen. The fruits were allowed to ripen on the trees. The fruits were extremely sweet, having pleasant smell, beautiful colour, very few seeds and of big size.

We stored the seeds thus obtained from fruits which had been allowed to get ripe on the trees and prepared the soil of sowing 1,000

seeds. When the plants were ready, we planted them on the prepared soil.

The growth of these 1,000 plants as we watched them, particularly at the end of 3 months, 6 months, and 9 months, was amazing. These plants were superior to those which were grown from seeds brought from outside. A view of the plants bearing fruits on the stalk about a foot above the ground in very great abundance fascinated everyone.

In the first year we supplied these seeds at 200 different places in India, Burma and Ceylon. The demand was so great that we had to postpone the execution of further orders to the next season.*

In the current season, we have stored the seeds of the "Madhubindu" type, carefully. The method of sowing the seeds, planting and the rearing of the papaya is described below.

How to plant the "Madhubindu" Papaya.

Soil.—Gorat, loose and fertile soil is best for papaya cultivation. The trees will not thrive on black and clayey soil.

Raising of Seedlings.—A good seed-bed is to be prepared and the seeds are to be cast after putting well-decomposed farmyard manure. The bed is to be watered everyday for a week, then on alternate days. The seedlings will be sprouting in a fortnight's time. When they are 6″ tall, they should be transplanted to the permanent beds at 8 ft. × 8 ft.

Planting.—The best time for raising seedlings is from May to September while that for transplanting is from July to October. One pound of seed is required to raise enough seedlings to be transplanted on an acre of land, i.e. half pound is required for a bigha.

Before transplanting, pits 3 ft. square and 3 ft. deep are to be dug. This should be filled in with half to one basket of farmyard manure well-decomposed, a few handfuls of ash, half a pound of castor cake and half a pound of bonemeal. All these manures are to be thoroughly mixed with the soil and then put in the pit.

Watering.—The seedlings should be watered immediately after transplanting and also on alternate days. The interval between two waterings may be 6 days in summer and 8 days in winter.

Manuring.—Since there is a very heavy bearing, papaya plantation requires manuring every three months. A mixture of one basketful of farmyard manure, 1 lb. of castor cake, 1 lb. of bonemeal and about an oz

* In order that the "Madhubindu" might be planted by people on a large scale, we fixed the rate of the superior seeds at eight annas per oz., and at seven rupees per lb., while the original rate at which we bought from outside was Rs. 2 per oz.

of Ammonium Sulphate should be prepared, and that is to be well mixed in the bed in a ring about one foot and half from the trunk of the tree. Two waterings to be given immediately. Then at regular intervals.

Male plants are to be removed as soon as they are detected. One male plant per 100 female plants is just what is required. The plantation can last profitably for three years.

The following are the salient features of the superior quality of the "Madhubindu" as compared with other types of papayas of the world.

1. There is no record in any country of the world that a papaya tree can bear fruits on the stem within two feet from the ground. It is given only to Rambag Plantation to declare that the famous "Madhubindu" bears fruits on the stem right from one or one and a quarter foot above the ground.

2. The number of fruits borne by the "Madhubindu" papaya trees is always double that of any other type of papaya.

3. There is more eatable stuff and less seeds in the "Madhubindu" fruit than in any other type of papaya.

4. There is more sweetness, more taste, and more pleasant smell in Rambag's Madhubindu Papaya than in any other kind.—(*The Modern Review, August 1939*).

CASEIN MANUFACTURE

Standardizing methods.—Attempts are being made at the Imperial Dairy Institute, Bangalore, to improve and standardize the existing method of casein manufacture, which while applicable to village conditions, would produce a fairly high-grade casein.

The manufacture of casein in India is still in its infancy, and acid coagulation, have been analysed and combined for colour and binding capacity.

It has been observed that a good quality casein of white colour can be made by washing the curd thrice with warm water and once with cold water in succession, and then drying it in the shade.

Lactic casein of fair quality and of light ivory colour can be made, but the quality and colour of the product could not be improved by washing the soft green curd.

A good quality casein can be made by precipitating it from separated milk and washing it with water and drying in the sun.

The cost of production is the highest in the case of rennet casein and the smallest for lactic casein. The binding capacity of rennet casein was nearly 2½ times that of acid and lactic caseins.

MILK FAT CONTENTS

A systematic study has been made at the Bangalore Dairy Institute of the variations of fat and solids-not-fat in the milk of dairy cows in relation to advance in lactation, age of the animals, season, feed, and breed.

This involved the testing of fat and specific gravity of about 24,480 samples and calculating the monthly averages. It has been observed that the fat percentage of the afternoon milk is always higher than that of the morning milk. The fat percentage is irregular for the first few weeks after calving, when it becomes steady and gradually rises with the advance of lactation. The percentage of solids-not-fat does not vary much but lies between 8.5 and 8.9.

As the animals advance in age, an improvement in the fat percentage is noted. Gir cows, which showed 3.8 percent during the first lactation, improved to 4.3 percent during the second.

World's milk yield record broken.—Messrs Wort and Way, of Red House Farm, Amesbury. Wiltshire, are the proud possessors of "Cherry" the now famous Shorthorn Cow, who recently broke the worlds' milking record with a yield of 38,678 lb. in 366 days, thus eclipsing the record previously held by Terling Graceful 10th, a British Friesian, in the herd of Lord Rayleigh. Cherry is expected to reach 40,000 lb., by Easter. (Rural Electrification and Electro-Farming Vol. XIV No. 167).—*(Extract from the Madras Agricultural Journal Vol. XXVII, June 1939).*

FIELD TESTS OF APPLICATION OF SULPHUR TO THE LAND

Since sulphur is one of the main constituents of wool, hair, and horn, it is necessary that it be present in pastures. Most crops remove more sulphur than phosphates from the soil, and in fact sulphur and phosphate deficiency are closely allied. It is estimated that under normal conditions wheat removes 12 lbs. of sulphur to 9 lbs. phosphorous per acre. Plants removing a quantity of sulphur from soil, such as the mustard plant and cabbage, respond well to sulphur in soil where deficient, i. e., less than .02 per cent sulphur. In some cases it has been found, following the application of sulphur the yield has been increased by 300 per cent to 400 per cent.

Sulphur aids nitrogen fixation. The fact that sulphur and phosphate deficiency are so closely related has been marked by the fact that superphosphate, 10 per cent sulphur, sulphate of ammonia, 24 per cent sulphur, and potash, 18 per cent sulphur, all supply portion of the soil requirements.

The most obstinate cases of "soil set" have been overcome by treatment with agriculture sulphur. Soils that were "too sticky" to plough when wet, and "too hard" when dry, have become easily workable in a month or two after broadcasting 10 cwts to 15 cwts of sulphur per acre. In less obstinate cases the sulphur may first be mixed with an equal weight of gypsum. This mixture (50 per cent sulphur, 50 per cent gypsum) can be applied at the rate of 10-12 cwts. per acre according to condition of the soil to be treated, and will be found to work with quicker and more lasting effect than gypsum, or more economical than sulphur, either used separately.

A member of the "Thiobacillus" group of soil bacteria has been isolated from sulphur treated soil and its growth in sterilised soil studied. By its action the pH value of the soil changed from 8.4 to 4.5 in 12 days, at which point the large amount of acid accumulated in the soil appears to be the factor limiting further growth.—(*Extract from the Journal of the Department of Agriculture, South Australia of July 1938*).

A POISON BAIT FOR SLUGS AND SNAILS

During the past year reports of the successful use of a new type of poison for destroying slugs and snails have appeared in several English horticultural and agricultural journals. This substance is metaldehyde. "Meta" a commercial product, consists almost entirely of metaldehyde, and baits may be made of this material, which is easily obtainable.

The bait has been found to be attractive and poisonous to both slugs and snails, and apparently does not lose its potency after rain or watering. The poisoned slugs and snails do not move far from the baits, so that large numbers of the pests are found lying in moribund condition. The poison acts slowly, and it appears that death is frequently caused by exposure to the heat of the sun and to dryness, rather than directly by metaldehyde poisoning. The baits are prepared by powdering two large tablets (8 gm) of "Meta" and mixing them thoroughly with one quart of bran. The bait may be used dry, but is probably more attractive when moistened by adding about half a cup of water to one quart of bran. This is less dangerous than the arsenic baits frequently recommended, but metaldehyde is poisonous to man, if eaten, and particular care should be taken in preparation of care should be taken in preparation of bait. It is recommended that the bait be broadcast, or placed in small heaps about 2 ft. apart where the pests are plentiful or around seedlings, which are attractive to them.—(*Extract from the Journal of the Department of Agriculture of South Australia of April 1939*).

STOCKING MADE OF CASTOR OIL AND COAL

Castor oil and coal appear to be the " Silkworm " from which the silk stockings American women will wear to-morrow may be made. With these basic ingredients, chemists are now fashioning, in their test tubes, a a viscous fluid which can be drawn into fibres that are finer and stronger than natural silk and have amazing elasticity.

While not yet ready for commercial production, chemists studying the new fibers aim at the goal of producing sheeter two thread stockings that will have the durability of four-thread hose.

In the postthomous patent of the brilliant du Pont chemist, Dr. Wallace Hume Carothers, just granted by the U. S. Patent Office, is revealed this strange fibre that gives promise of being silk's crucial rival in the hosiery field. The new patents implications to a nation like Japan producing the great bulk of the world's natural silk, are not to be overlooked. When and if the chemists decide to bring the new product out of the laboratory, America, with its vast supplies of coal, will be a step nearer freedom from foreign domination of its silk requirements.

The new silk is not rayon, for its origin is not from the cellulose of growing plants like cotton or wood, but from coal and its highly important coal-tar derivatives. Coal-tar has already produced thousands of organic compounds that range from perfumes which nature never knew to explosives and dyes and even to organic compunds of the human body itself, one of which is called cadaverine.

Out of sticky black tar, formed as coal is heated and its vapor caught by distillation, a long series of steps can duplicate cadaverine. It is by this completely synthetic method that Dr. Carothers prepared his material from which the silk-rivaling fibers come.

Castor oil enters into production of the new fiber because it is used to form an acid which is reacted with the cadaverine. This is sebacic acid. To make it, chemists first make a castor oil soap (just as soaps are made out of palm oil and other vegetable oils). Heating this castor oil soap with sodium hydroxide creates sebacic acid.—*Extract form the Scientific American of December 1938*).

College and Hostel News

Events during this year have made it unforgettable in the history of the world. No less forgettable will be this year to the future historian of our college. It was on the evening of 22nd August 1939, that unfortunately the north porch of the college building suddenly collapsed embedding underneath the debris Professor B. R. Phatak's car with its two female occupants. It was on account of the marvellous heroism and courage displayed by the students of the college and the others who were present on the scene, that immediate help was rendered and the occupants were promptly extricated. Any way we have to thank the Almighty for averting what would otherwise have been a great tragedy.

The accident had for reaching repercussions on the usual working of the college as the college building was immediately declared unsafe for occupation. Mr. J. F. Dastur, our Principal with remarkable promptness characteristic of him was equal to the occasion, and with no loss of time the college classes resumed working partly in the hostel, and the machinery shed. Thanks to the University authorities and the Principal, College of Science, who have permitted the use of their rooms for holding our classes. The college has, by now, somehow adjusted to the present make-shift arrangement. The co-operation of the students and the staff with the Principal in meeting the situation is most appreciable. We are hearing since long the proposal to shift the college to a suitable site away from Nagpur. "Out of evil cometh good." Will not the present accident fulfill the long wished want ?

The past few days were full of the college social activities. The College Debating Society and the Quiet Hour Society held two meetings each.

The Janmastami and Ganesh Festivals were marked with great enthusiasm and co-operation. The Hindi Historical Drama "Rakshabandhan" was a great success. The choice of the characters was very clever, and the gorgeous costumes presented a real picture of "The splendour that was Ind."

We have the pleasure to congratulate the following for winning the following competitions :—

Elocution competition,

Mr. M. K. Oka	1st prize.
„ R. C. Deshmukh	2nd „
„ D. N. Kherdekar	3rd „

Essay writing competition,

Mr. M. W. Khankhoje	1st prize.
„ S. A. Stevenson	2nd „

The college sportsmen are busy practising for the University Tournaments. The College Foot-ball Team won the first round of the University Tournament against the City College but unfortunately lost the second round against the College of Science after having been drawn once. Our Foot-ball Team seems to promise a brilliant future.

REVIEW

Mushahidat-i-Qudrat in Urdu by Khan Bahadur Abdul Qayum, Retired Deputy Director of Agriculture, U. P.

The book deals with various subjects connected with nature study in a simple and convincing style. One can follow what the author wants to explain by looking to the diagrams in the book which are simple and illustrative. The book is an attempt to improve children's observation and power of grasp. (M. A. R.)

NOTICE

Qualified agriculturists, who are interested in colonization of the educated unemployed, should get into touch with the Deputy Commissioner, Raipur, with reference to the scheme for the colonization of the Disaforested Parsada Block of the Mahasamund Range.

Dated *the 7th July 1939.*

E. A. H. CHURCHILL, *Principal.*

OBITUARY

We regret to record with great sorrow the sad demise of Rao Saheb B. V. Vaidya, Retired Superintendent, Government Gardens, Pachmarhi on July 13, 1939, at Jubbulpore. In him we have lost a grand old man of the Agricultural Department. Starting in 1872 he served the department for full 37 years. The beautiful Government Gardens in Pachmarhi which are his creations, stand as a great testimony to his horticultural genious and his indefatigable industry. In recognition of his services he was awarded the title of Rao Saheb in 1923. May his soul rest in peace.

ERRATA FOR THE COLLEGE MAGAZINE No. 4 of MAY 1939

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146	17	in doors	in-doors
146	20	800 C to 1,500 C	800°C to 1,500°C
146	32	it's	its
147	27	caroten	carotene
154	19	an	a
164	11	drive	driven
167	8	fastend	fastened
167	29	cynamiade	cyanamide
169	2	megess	megass
169	8	it's	its
172	37	ion	iron
185	20	it's	its
185	33	regularity	regularly
186	26	groundnut	Shinghara
187	9	case in	casein
191	8	K. S. Krishna Rao 2	K. S. Krishna Rao 1

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Editorial

GRADUATES WITH THE GREEN BADGE

We are sure that the words of advise which Mrs. Sarojini Naidu gave in the course of the inaugural address delivered by her on the occasion of the recent Convocation of the Nagpur University, have sunk deep into the minds of all those who were present on the occasion. Of the services of the graduates, which Mother India was in dire need, she laid particular emphasis on the services of the graduates with the green badge—Agricultural Graduates. That graduates with the green badge should have engaged her first attention in her words of advice to the young products of the Nagpur University, is a clear proof of the important roll which men trained in Agriculture have to play in the National Freedom. The following message from the learned speaker is worth being remembered by every aspirant for the green badge.

" What I want you to do is this. Here are men with green badges, those who have learnt the secret of the earth. To-day, remembering in my own province, in my own dominion of Hyderabad, how naked famine stares, how children go hungry, how the Mother—so compassionate through the centuries—refuses one grain of wheat; I think first of those who bear the green badge to-day. The need of India has always been through her earth, and for her earth, and the children who would work in the earth. Through all these centuries she has fed us; she has given, season by season, by tearing open her heart, harvests that have made us live. Now the

old Mother has grown weary, she is exhausted and she, who fed uncounted generations, now asks for food from her young children. And the first duty in the great freedom of the country, and therefore, in the freedom of the world is to feed the exhausted Mother, to give all that knowledge, that skill, that experience in experiment that has brought you this green badge to-day. Give it all to that old Mother and make her young again, so that unborn generations will be fed by her soils and enrich you by her spirit created in you. The problem of Agriculture is one of the supreme problems of Indian Freedom and the problems of the peasants who till, reap and sow. This is the urgent problem of Indian emancipation. It sounds so dull. There are no bayonets, there are no bombs with it. There is nothing spectacular about it. It is a drudgery from day to day. It has to keep pace with the vagaries of the seasons, the dew, and the Sun and the rain and the rain that fails. How will you protect the Mother so that she may feed us once more ? So to you who have taken the Degree of Agriculture, I say, go with both hands and be '*annadata*' (food giver) to her who through centuries has been ours."

BEE-KEEPING CLASSES

A special feature of the activities of the Entomological Section this year has been the opening of a class for studies in the 'Methods of Bee-keeping.' This class met from 16th October to 8th November, 1939. There were 40 students in the class including 6 ladies. Most of the students were Agriculturists. A dozen colonies of bees were maintained and the College Orange Garden and the Entomological Field Laboratory area were humming with bees. 'Bee-keeping' can be a profitable Cottage Industry in this Province and the Entomologist to Government C. P. and Berar deserves to be congratulated for popularising the study on this subject. It is proposed to hold another class during the month of March 1940, and we hope that within a few years this industry will be well established in this Province.

RETIRED OFFICERS

A few months ago Rai Bahadur G. R. Dutt, B.A., Entomologist to the C. P. Agricultural Department retired after spending 9 years in this Province. Although he was associated with this Province for only 9 years, by his qualities of head and heart he had endeared himself to the public at large and to the staff and students of the Agricultural College in particular. His smiling face and imposing personality, evidences of a well preserved body, were the envy of many of the juniors. We hope that the days of his retirement, in his native home in the land of the five rivers (Punjab) will be perfectly happy ones.

Prof. B. R. Phatak, B. Ag. (Bom.), Extra Assistant Director of Agriculture, attached to the College of Agriculture has been granted four months leave preparatory to retirement. Prof. Phatak started his official career as Lecturer in Agriculture in the College of Agriculture, Nagpur, and has been on the staff of the College for full thirty years. To spend thirty years in one institution, loved and respected by his officers, colleagues and students is a glorious achievement of which he should justly be proud. Prof. Phatak by his erudition, benevolence and enthusiasm in the college activities, had endeared himself to everyone in the College. With his retirement the College has certainly lost an experienced teacher. But work must have rest. We wish the learned Guru, a long period of retired life full of health and happiness.

Mr. N. G. Sule, Extra Assistant Director of Agriculture, Southern Circle has also retired. He may not be known to many younger generations of students of the College. He was for many years Overseer on the College Farm and was the officer who was entrusted with the task of laying out the Nagpur Municipal Sewage Farm, on the Nagpur Bhandara Road. Our best wishes go to him for a long and happy retired life.

ARTIFICIAL INSEMINATION

Value of animals belonging to high productive strains, and possessing ability to transmit their characters to their progeny, is being recognised by live-stock breeders. Although prepotency is

not restricted to only the male sex still the bull is considered to be half the herd by cattle breeders, because of the greater number of offspring which the bull is able to procreate. Hence it is necessary to make the greatest possible use of pedigree bulls with proved ability of transmitting qualities of high production. In India one male buffalo is necessary for a herd of thirty buffaloes which come into heat within a short period during the rains, while in the case of cows which come into heat during all months of the year, one bull can impregnate fifty cows. The number of breeding bulls of high quality required for the population of cows and cow buffaloes in India is enormous. Great possibilities are therefore presented by the "Artificial Insemination" process, in which semen from desirable bulls are collected and stored soundly and injected into the uterus of cows when they come into heat.

Spallanzani was the first to carry it out successfully in the dog. Since then successful reports have been made among humans as well as in the rabbit, dog, horse, cow, sheep and domestic fowl. In Russia and certain states of the United States of America, this process is being practised on a commercial scale with cattle, sheep and horses with considerable success and advantage.

Advantages of the process of artificial insemination are: (1) The sperms or male element collected from one service of the male can be used to impregnate several females. (2) The semen can be collected and sent long distances, thus making it unnecessary for the animals concerned to come into contact. (3) Spread of Venereal disease and contagious abortion is controlled by avoiding direct contact between animals. (4) Cows which are barren by reason of certain localised diseases or anatomical defects of the vagina can be fertilized by this process.

The technique of artificial insemination consists of collection of semen from the bull, its storage in a viable condition for a number of days, and its introduction into the uterus of the cow by a proper syringe. An English firm supplying veterinary appliances manufactures and markets suitable apparatus required

for artificial insemination among cattle. The equipment consists of a specially designed artificial vagina, in which the bull is made to discharge the semen or the male seed, a number of test tubes, beakers, and glass measuring devices in which the seed is measured and diluted with specially prepared salt and sugar solutions, an instrument for dilating the vagina of the female and illuminating the passage, and an all-glass syringe with a specially made glass or ebonite nozzle for introducing the semen into the uterus. The females must be inseminated at the time of their natural heat, when the egg cells are produced by the ovary.

The seed or semen can be preserved for several hours or days during which time it can be conveyed by post or other means of transport over greater or smaller distances. It has been possible to preserve the seed of the ram for 5 days, the bull 3 days and the stallion only 12 hours. Experiments are being conducted regarding storage of the semen at low temperatures over long periods.

In Ceylon the Veterinary Department has announced that the semen from the Ayreshire bull " Rowllan Simon " is available at Perdeniya and that persons who wish to get their cows inseminated should see (1) that the cow is in heat (2) that information is given to the Veterinary Officer trained in this method, by telephone or telegram, who will proceed by car to carry on the insemination (3) that heifers which never had a calf are not as suitable for this method as cows which had at least one calf (4) that the owner will be required to inform the veterinary laboratory in due course of the result of the artificial insemination.

In the New Jersey and New York States of the United States artificial breeding circles have been founded in 1938. Although these pioneer organisations admit that the possibilities of their activities have not been yet fully proved, they are of considerable interest and the participation of breeders in the project is extremely encouraging. This participation is greatly favoured by the prevalence of venereal diseases, the result of direct contact of animals. The New York State Association has a minimum

number of 500 cows, the total number admissible being 1,200. Herds belonging to the Association should be located within 20 miles radius of the Association headquarters. Two bulls are kept. Semen is collected from each bull on alternate days. Therefore one ejaculation is available every day, which-diluted-can fecundate several cows. If the first artificial insemination is unsuccessful, a second and a third will be performed without charge. The Association also examines the member's cows for pregnancy and will also treat them if they show any breeding trouble. A certificate is issued by the Association after each successful breeding attempt, stating the bull's name and number. For these services the member-breeder pays a membership fee of 5 dollars and an assessment of 5 dollars per cow at the time when the insemination is performed.

Original Articles

NOTES ON PLOUGHS

E. A. H. Churchill, M. A., B. Sc.

(Principal, College of Agriculture, Nagpur).

The ploughs are the most important of all implements. The Royal Commission on Indian Agriculture dealt very properly with the subject of the country plough. They pointed out that its chief advantage, is its suitability for a poor man, who can only afford one implement, because he can do almost all his work, cultivation, sowing etc., with this plough. Its chief disadvantage of course, is that it is not a plough in the proper sense, and is only equivalent to what is known as a cultivator or grubber in Great Britain. There is little more to be said on this point. It may be noted however that the "Nari plough" is a very good seed drill, provided labour is cheap. It is a mistake however to say that iron ploughs cannot be used for sowing. They can be and are used for this but like the Nari, they are very slow as compared with the most ordinary type of seed drill and are not therefore frequently used.

The names given to various ploughs requires careful consideration. For instance there is great confusion on the subject of the "Stubble" and "Sabal" ploughs. The S. A. E. plough is given as an example of

"Stubble" plough by those, who escape the confusion with the "Sabal". Now "Stubble" is a purely relative term, and the S. A. E. may be a "Stubble" plough in America, it is not in Great Britain, where its exact opposite, the Sod plough, may quite well be used and frequently is for ploughing out stubble. To go further "Sod" may quite easily be considered the stubble left after a "seeds" crop, i. e. grasses used in a rotation. Again "Sod" is an American term, and I prefer the English word which is correct, more original, and less likely to be confused by students. The English word is "Lea". One of the earliest types of inversion ploughs was the English Lea Plough, well represented in the College Machinery Hall by the old Essex Plough. "Lea" is an old English word meaning a meadow or field usually of grass for pasture. In its strictest sense, it refers to the "Seeds" or grass fields in the last year of the "Seeds portion of their rotation." In an English five, six or seven course rotation, two to three years of the rotation may be "Seeds" that is artificially sown mixed grasses and clovers for hay or pasture. Either during the whole of their last year under seeds, or the last portion of the last year, these fields are grazed flat by sheep or cattle—preferably sheep—before being ploughed up again, for the next course in the rotation. It is strictly speaking during this pasture period, that the field may be called a lea. It was thus only natural that the plough used to plough it up, should be called a Lea Plough.

The Lea Plough happens to be the extreme form of that type of plough to which it has given its name. These implements are at one end of what may be called the "plough line." They are distinguished by their specially shaped shares, the gentle incline of the breast, the great length of the mould board, and its shape. The draft is very light, the plough is easy to handle, and its action ensures complete inversion, with the minimum of pulverization. This action is designed to counteract the results of prolonged frost, i. e. the pitching or settling down of land. It can thus be understood that the lea plough is a plough of temperate climates or zones. It is common to great Britain, parts of Europe and the Maritime Provinces of Eastern Canada.

At the other end of the "plough line" we find the *Digging Plough* represented by the South African Eagle, for the Cotton soil, in its more extreme form. The digging plough is distinguished by its share, which is of the ordinary knife shape, and so fixed on, that it produces a glancing or slicing action in cutting its way through the soil, the short mould board with the steep breast, producing a very powerful pulverizing action and leaving inversion as a secondary consideration. The digging plough

is the plough of tropical and sub-tropical climates. The draught is usually fairly heavy as compared with a lea plough.

In between these extremes there are all sorts and types of ploughs, and the medium type may be termed General purpose ploughs. At the "Lea" end of the line, the next type exhibited in the College Machinery Hall is the Ransomes R. Y. L. (a very fine plough). In the same way at the "digging" end of the line, the "*sabal*" is a good example. In the middle are various types, which are represented by the "Turn-wrest" amongst others.

The most important part of the plough is the "bottom". This is the complete iron work sold when small ploughs of the Meston, Monsoon, Malwa and other such types are purchased. The plough bottom is not a single part but a combination of parts, *i. e.* the share, mould board, and body including the landslide. It cannot be too forcibly impressed that for every type of land there is a suitable plough bottom, and that the really skilled farmer knows exactly, which one to employ on any particular land.

I am not certain that although the lea plough is not as a rule a suitable plough for the tropics, that a good deal of benefit cannot be derived from the use of a mild lea plough of the R. Y. L. type on the raw soils of India especially the cotton soils. One cannot but recognise that this plough is a favourite with the farm ploughmen, who do good work with it (the best I have seen with bullock drawn modern ploughs in India). The draught is easy and the plough is steady, requiring only the minimum of "holding to its work". Cotton soils work very freely on their own and pulverization is perhaps not so very important, specially if the more correct digging bottom, will do away with so many of the advantages given above.

Another point in favour of the lea type plough is the complete burying of bulky manure, or a green manure. The raw Indian soils are greatly in need of bulky organic manure, and the value of this manure is greatly increased by being properly buried, as its physical action on a raw soil is one of its chief virtues. The cotton gutter dust and such manures, are better buried by lea ploughs than by the digging type, in which pulverization comes *before* inversion.

This note would not be complete without remarking that, I do not understand the extra-ordinary importance accorded to the Turn-wrest, or Hill side plough. It is a bad plough, a study of its mould board will show this. It is an improvision, a compromise, which should only receive such consideration in its own country, the hills. I prefer its real name i. e. "Hill side plough". There is undoubtedly some very good and proper explanation for its introduction into the flat country. It is certainly the

cheapest form of one way plough, but this should not be lost to consideration. It is a compromise, and it is impossible to construct a really correct bottom on these lines. One way ploughs are of course in use everywhere, but they are all provided with two bottoms, for example, the Ransomes one-way balance plough as illustrated, so popular in Kent, and other parts of Great Britain where the soils are light, and the Canadium One-way sulkey. The "Sabal" and such fixed mould board ploughs are infinitely better implements than any of the turn-wrests. The bottoms are correctly made and the design is not handicapped by any necessity for building a mould board or share, which has to turn the furrow in both directions. The cultivation of hill-sides is the sole excuse for the introduction of the turn-wrest plough, and it is not of great importance that this hill-side plough is not a very correct one, since if the slope is so steep as to render the use of a turn-wrest plough a necessity it is also too steep to turn a proper furrow.

It is very necessary to understand the correct "hitching" of a plough, as there is an impression about that all that is required, is that the bullocks shall draw the plough and the ploughmen must then hold the plough to its work. A properly hitched plough hardly needs any touching. All the small ploughs, Monsoon, Meston, Malwa etc., worked with long poles to the bullock's yokes, are improperly hitched, as the poles are set on straight ahead, allowing of no offset. It is not generally known, that Messrs. Ransomes never intended their Monsoon plough to be used with a long pole. Complete Monsoons as delivered by Ransomes, have short wooden beams, and hakes for chain draught (see illustration). The Bihar plough of which some specimens exist in the Northern Circle at Adhartal and Chhindwara, is an example of a small plough designed to overcome the offsetting difficulty. It was designed by Mr. A. P. Cliff, Deputy Director of Agriculture of North Bihar, and has done extremely good work at Adhartal. Mr. Cliff maintains rightly that it is useless using a modern iron inversion plough, unless it is used properly. The principles can be applied to any pole draught ploughs, and had already been applied to the Monsoon in Adhartal, before the introduction of the Bihar Plough.

It will be necessary to allude to special forms of ploughs; the Disc Plough being one. This was the invention of a Canadian farmer in an attempt to reduce the draught of a digging plough, by the introduction of a rotary, or wheel-like motion. The Sabal plough is also a special plough, the original idea of "Ransomes" designer being to produce a plough with a very strong unbreakable share point, which could easily be withdrawn, and sharpened by any simple village blacksmith. The "Sabal" is a very good plough, and should be used much more than it is.

The illustration (Fig. 1 on page A) gives the "Monsoon" plough as sold complete by the makers, Ransomes Sims & Jeffries. Offsetting is arrived at in the ordinary way, as for a Sabal or any other type of chain draught plough. The M. S. N. is sold by Ransomes with a long pole draught, which is not offset. The firm however maintain that the M. S. N. is too small a plough for ordinary cultivation. It was made for puddling rice bundies, for which accurate ploughing is not necessary.

A Ransomes Balance one way plough, showing both mould boards correctly designed is illustrated in Fig. 2 on page A.

CULTIVATION OF CHILLIES

DHANNALAL, L. AG.

Introduction.—Chillies owe their origin in Tropical America and have been introduced in India somewhere about the middle of the seventeenth century by the Portuguese. There are at present many varieties of capsicum which are by far the most important of crops of the class of condiments and spices occupying a large area both as garden and field crops. The crop is cultivated in various parts of India, but no separate statistics of production or of acreage are available. It is also cultivated throughout Central Provinces and Berar. At present the cultivators are in search of a money crop due to the phenomenal low price of cotton. Under these circumstances it will do well to them to devote part of the land towards growing chillies. There is no fear of unremunerative prices due to an increase in the supply as at present the supply is much below the demand and the prices are also fairly high. Another point in favour of growing this from year to year is the possibility of getting progressively better returns, for it is observed that Chillies give a better yield when grown successively.

Varieties.—There are a number of varieties of chillies, the chief ones being the long and the short, the latter are generally sold green while the former are allowed to ripen on the plants before harvest. There are two types in the long variety the thick skinned and the thin skinned. Also there is a variety, the capsules of which are short varying from $\frac{3}{4}''$ to $1\frac{1}{2}''$ in length and conical in shape. In taste they are pungent. There is also an interesting variety which has the shape and the size of tomato and being hardly pungent is cooked as vegetable.

In this Province, the Pandhurna as well as the Malkapur types are well known. The former are noted for its length while the latter is rather short but is particularly pungent.

Soil.—The successful cultivation of this crop depends considerably on the nature of soil on which the crop is grown. A well drained sandy

loam well supplied with organic matter is best suited for this crop. In the Central Provinces the best dry crop of Chillies are grown on deep retentive black soil and the irrigated crop in mixed black soil.

Manure.—Land intended for this crop must always be well manured from 20—25 cart loads of well rotted farm yard manure. Besides a mixture of 60 lbs. of ammonium sulphate, + 112 lbs. of Superphosphate, + 180 lbs. of Potassium Sulphate should be applied before the lay out. Experiments carried on these lines on the College Farm have proved successful.

Raising of Seedlings.—Chillies yield the best results when grown from transplanted seedlings. The end of May or the beginning of June is the best time for sowing chilly seeds for the production of seedlings for subsequent transplanting in the field. An area of about 300 to 400 square feet should be carefully worked by digging and pulverising the soil, so as to prepare a very fine tilth for the seed bed. The area mentioned above would suffice to raise seedlings for an acre. The area should be subdivided into small beds of 6' x 3' or 8' x 4' or any similar convenient size. 1 to 1½ lb. of seed is quite sufficient for the purpose. The nursery beds should be burnt first. Immediately after sowing, the seed should be carefully covered with fine earth the beds should then be pressed and irrigated lightly daily in the morning and evening. Special care should be taken to apply irrigation water slowly and carefully so as not to disturb the seeds. The seed beds are generally covered with grass in order to conserve moisture and protect the seedlings from the scorching heat of the sun in their early stages of growth. The watering should be continued every 3rd or 4th day until germination has taken place. Thereafter the beds should be irrigated once a week. In about 4 to 5 weeks time the seedlings will reach a height of about 9" to 12", when they are fit for transplanting in the field. The covering of grass should be removed soon after the seed has germinated.

Cultivation.—Previous to planting, the field in which the seedlings are transplanted should receive a very thorough preliminary tillage. After the previous crop is removed, a good ploughing with a Turn-wrest plough followed by two bukherings should be given to the field to produce a fine tilth in the upper soil layers. 25 cart-loads of well rotted Farm Yard Manure should be applied to the land and ploughed in. Before planting, the soil should be ridged up 2' apart with an E. T. plough in areas having a heavy rainfall and heavy soil. On light lands planting is done on flat land and earthing done later. This system of ridging is more economical than ridging by hand labour. The ridges

should finally be dressed by hand and irrigation channels constructed across the field. The nursery area i. e. seed beds should be irrigated one day before the seedlings are removed in order that the soil may be softened and the seedlings removed without injuring their roots. A bunch of 2 to 3 seedlings should be planted in the field at a distance of 18" to 2' on the side i. e. half way between the crest of the ridge and the bottom of the furrow.

Transplantation.—The seedlings will get ready in about 5 to 6 weeks. They will then be 9" to 10" high. 2 to 3 seedlings should be transplanted on a cloudy day or in the evening. The suitable time of planting is evening or cloudy day. 2 seedlings in a bunch is generally recommended.

Irrigation.—No irrigation is given in the monsoon if there is sufficient rain in any case until October, not even after October if the late rains are favourable. If there is long break, irrigation is necessary. In other seasons irrigations are given almost weekly or fortnightly as found necessary. Over-watering does great firm and spoils the fruit. This crop is also grown as an unirrigated crop during rainy season.

Subsequent operations.—The crop is weeded and land stirred as required till the crop begins to fruit. When well established the crop is earthed up after about 2 months from the time of transplanting. In dry crop cultivation, bukher is worked lengthwise and crosswise. A top dressing of Sodium Nitrate at the rate of 60 lbs. per acre at the end of August should be given. This will help the number of flowerings and hence the amount of fruit. There-after the plants are earthed up to prevent lodging.

Diseases and pest.—It has been usually seen that the curling of leaves called "Murda" is very common on this Farm on account of mites and is particularly noticed after one month of planting and is seen to be more virulent if there is excessive rains. Hence the best remedy is to spray the crop with Lime Sulphur wash. This treatment is very cheap and quite harmless to the plant, its only effect being to check the pest.

Harvest.—About 3 months after transplanting, the first fruit forms. Picking goes on for 3 to 5 months and the irrigated one lasts longer. The stage of maturity at which Chillies are picked depends on the purpose for which they are grown and the demand in the market. Ripe chillies are picked 4 to 5 times in the course of the whole season. After picking the crop is prepared for market by exposing the pods out on mats to dry in the sun.

Out-turn.—The yield of chillies varies considerably in accordance with the tillage and the manurial treatment given to the crop. Yields range from 700 lbs. to 1,000 lbs. in case of dry crop cultivation, whereas 1,200 to 2,000 lbs. when irrigated. On this Farm a yield of 2,500 lbs. have been obtained on good years. The crop sells at about 8 lbs. per rupee.

Cost of cultivation of Chillies on the College Farm, Nagpur.

			Rs. A. P.
(i)	*Manuring...*	...	39 12 0
	(a) Cost of 25 cart loads of F. Y. M. @ Rs. 1/8/- each Rs. 37/8/-		
	(b) Spreading charges 12 women per acre = Rs. 2/4/-		
(ii)	*Preparatory Tillage-ploughing once with a heavy plough.*		5 6 0
	(a) 2 pairs of bullocks @ -/12/- per day	1 8 0	
	(b) 3 men at -/5/- per day ...	0 15 0	
	(c) Depreciation and interest Area ½ an acre a day ...	0 4 0	
		2 11 0	
(iii)	*Bukhering three times...*	...	2 2 0
	(a) 1 man at -/5/-		
	(b) One pair of bullocks -/12/-		
	(c) Area 1½ acre a day		
(iv)	*Fertilizers...*	...	26 12 0
	(a) Ammonium Sulphate 60 lbs @ Rs. 4/9/- per Md. ...	3 7 0	
	(b) Super Phosphate 112 lbs @ Rs. 4/12/- per Cwt. ...	4 12 0	
	(c) Potassium Sulphate @ Rs. 11/-/- per Cwt. ...	17 10 0	
	(d) Spreading charges 5 women ...	0 15 0	
		26 12 0	
(v)	Opening furrows with an E. T. plough and making beds and channels	...	3 4 0
	(a) 2 men -/5/- each ...	0 10 0	
	(b) 1 pair of bullocks ...	0 12 0	
	(c) 6 men to dress ...	1 14 0	
		3 4 0	
(vi)	*Cost of seed and the nursery....*	...	7 5 0
	(a) Cost of 1½ lbs seed ...	0 6 0	
	(b) Digging the seed beds 20 (6' x 3') ...	0 14 0	
	(c) Further operations ...	1 2 0	
	(d) Manuring 1 cart load ...	1 8 0	
	(e) Labour of Mixing—1 man ...	0 5 0	
	(f) Weeding 3 times ...	1 2 0	
	(g) Irrigations ...	2 0 0	
		7 5 0	

(vii)	*Transplantation....*	...		2 4 0
	(a) Up-rooting seedlings 2 women	...	0 6 0	
	(b) Transplanting 10 women	...	1 14 0	
			2 4 0	
(viii)	*Weeding and mulching 3 times....* 10 women each time 1/14/-	...		5 10 0
(ix)	*Earthing by planet junior hoe. ..*	...		1 8 0
	(a) 2 men	...	0 10 0	
	(b) 1 pair of bullocks	...	0 12 0	
	(c) Depreciation	...	0 2 0	
			1 8 0	
(x)	*2 sprayings with lime sulphur wash...*	...		6 0 0
(xi)	*Irrigation charges....*	...		26 6 0
	(a) The depth from ground level to the water level was 20'—25', 150 buckets of 1½ gallon raising water 3,000 gallons per hour were used. By means of this Persian Wheel one will irrigate 1 acre in about 1½ days working 8 hours a day. Labour units 1 pair of bullocks -/12/-, 2 men -/10/-. Hence for 9 irrigations the amount comes to Rs. 19/4/-			
	(b) Depreciation and interest per acre per annum taking 8 acres to be managed under one Persian Wheel costing Rs. 240/- ...		4 9 6	
	(c) Depreciation on well costing Rs. 400/-		2 8 6	
(xii)	*Picking charges.*—	...		9 12 0
	(a) Picking chillies 48 women			
	(b) Cutting and removing plants 4 women			
(xiii)	*Land revenue.*—	...		5 0 0
(xiv)	*Watching charges.*—	...		1 0 0
	Total cost of cultivation ...			142 1 0

Amount realised by sale of crop 1,600 lbs. dry Chillies on an average, @ 8 lbs per rupee.	...	200 0 0
Hence the net profit is	...	57 15 0

AN ATTEMPT TO GROW KAJU (CASHEW-NUT) IN SOHAGPUR, HOSHANGABAD DISTRICT

D. P. PERSAI, B. Ag.

Kaju is a very popular dry fruit in India. It sells at about annas eight per lb. Pandit Biharilal Tiwari, who is interested in the introduction of new plants, wanted to see, if it was possible to grow cashew-nut tree (Anacardium Occidentale) on a portion of his land at Sohagpur, District Hoshangabad. An account of his trials is given below :—

He attempted to grow firstly, by means of cuttings which were planted during the rains of 1923 but unfortunately they all failed to strike roots and rotted. Then he thought of propagation by seeds. In his enthusiasm, he paid as high a price as Rs. 5/-/- to get five seeds from one hoax dealer. These were germinated in a nursery but did not survive after seedling stage. A second consignment of 100 seeds for Rs. 5/-/- was obtained from a firm and grown in nursery in the winter of 1924. They germinated well but died later on. In the third attempt, three bags of cashew-nut seeds (each bag containing about 91 lbs.) were obtained from the Director of Agriculture Bombay for Rs. 4/8/-. This was germinated in the nursery as usual and divided into three lots for transplantation.

A field was measured and laid out. Pits nearly 2' x 2' x 2' were dug, at distances of 18' to 20'. The excavated soil was refilled and the plants were transplanted. The soil of the field, had a mixture of sand and clay in its upper crust, the proportion of sand being more. With the increase of depth, the proportion of sand decreased till at five feet, there was pure clay.

Two lots of seedlings were transplanted during winter and spring respectively in these pits. They did well for some time but died ultimately. The third lot was transplanted in the month of July 1926. At this time plants were 1' high, supported by a 4' long tap root and many secondary roots. In August new red leaves were given out. Watering and other cares were regularly attended to. Plants grew well and were about 9" and 2' feet high in the month of October of 1927 and 1928, respectively. New branches and leaves were added every year. In the year 1931, i.e., about 6 years after sowing, blossoms appeared for the first time. It lasted for three months *viz* October to December, but fruiting did not set in. In December of 1932, blossoms appeared all over the plants and fruits formed. At present, there are 40 trees in his field. On an average 1 lb. of Kernel is obtained from each tree. Cashew-nut tree in other parts of India, are reported to give 2 lbs. of kernels. On the assumption

that there will be 120 trees on an acre, with even an yield of 1 lb. per tree, the money value will be nearly 60/- Rupees per acre.

Mr. I. A. Sayed, B. Ag. in his article "The development of the Cashew-nut Industry in India" (Agri., and Livestock, India, Vol. IX part I 26-41.) says, "with its recognition as an article of consumption as well as one yielding several by-products of economic importance which promises the development of international trade, the cashew-nut is now receiving the serious attention of the grower and the commercial men, who have begun to take up its cultivation and develop internal as well as overseas trade;" Of course, it is not suggested that crops like cotton, jwar or wheat should make room for cashew-nut trees on good land. But many inferior lands particularly suffering from want of uniform level, may be put down under cashew-nut which can grow under a variety of climatic conditions and requires very little care.

THE SOYA BEAN

MR. K. P. LELE,

Student, Junior B. Sc. (Agr.), Agricultural College, Nagpur.

Botanical name—Soja Glycine.

Natural order—Leguminoseae.

Sub order—Caesalpinioideae.

The claims of Soya-bean, for being a providential gift to man-kind, have, of late, received universal recognition though it has been the mainstay of a whole nation, for ages. For centuries the Soya bean has occupied an important position as a food crop in China and Japan. These and the adjacent countries are the chief centres of production. The value of the plant is now securing wider recognition, and its cultivation is extending to Southern Europe and the United States of America: It has been stated that the main value of Manchuria to Japan is primarily as a source of cheap and ready food supply; incidentally, most of Manchuria's cultivated land is devoted to the production of Soya beans.

Since 1907 these beans have been growing in importance as a commodity for export all over the world. Great Britain for example, imported 160,000 tons in 1935, while Germany's importations for 1934 amounted to no less than one million tons.

It looks like a slightly smaller lima-bean, has a harder texture, a bitter taste. Yet, insignificant as its appearance is, two civilizations in characteristically dissimilar ways have honoured it. Five thousand years ago Emperors who were called the "Sons of Heaven" rode out to bless its planting with awe-inspiring ceremonies addressed to Hou-Tsi, the grain God.

The Chinese sages five thousand years ago, called it "Tateon." But ordinarily people rejected the faint highbrow flavour of a botanical expression coined by sages and called it "Sou." The Japanese who took the seed beans with them to Asia's certain islands changed the accent a little, the bean itself called "Soja" and the piquant sauce which they made from its juices "Shoyu" and in the early 18th century the accent was whittled down into the crisp occidental "Soy."

Five thousand years ago, the written records show, its production was a great agrarian industry. Peasants from Manchuria to the tropics turned the soil for it, and doubtless fought chinch trugs with subtle spells and poison.

Already in those distant years, the Chinese knew "Tateon" as a plant of almost miraculous diverse uses. Even under worst conditions of temperature and sun-shine, the healthy Soya-bean vine rarely fell below half its yield and is a mainstay against famine. Nursing mothers throve on it; farm animals grew sleek and strong when Soya-beans were mixed in their diet. As far back as 2838 B. C. the Emperor Shen Nung, an all-round pundit of China's ancient sciences listed 300 ways in which Soya products were good for human ailments.

Soil.—Soya-bean is suited to a fairly wide range of soils; it prefers the loamy type, such as are best suited to maize, and although benefiting from ample supply of soil moisture, it will stand dry conditions much better than maize.

Soil inoculation is an interesting point in connection with the Soya-bean. It has long been known that certain bacteria must be present in soil to enable legumes to make use of atmospheric nitrogen. Where, bacteria are absent or are insufficient, growth is improved by treating the seed with a culture of nitrogen fixing bacteria prior to sowing. Some important increases in yield and nitrogen content have resulted from this treatment, notably in U. S. A., where Soya-beans promise to become an important crop. In the chief producing districts, in which the beans are taking the place of oats in the cropping system, the rotation is maize, Soya-bean, Wheat and Clover. In C. P. well drained Morund soil is best suited for its cultivation.

Varieties.—The Soya-bean is an erect-growing, annual leguminous plant, the leaves resembling those of ordinary beans or cow peas. There are numerous varieties varying considerably in height, character of foliage and the colour of seed which may be yellow, green, brown, black or a combination of these colours.

In C. P. the Soya-beans may be classified according to the season of sowing i. e., Kharif or Rabi. On the Nagpur farm the following Kharif

varieties are sown. They are the selections recommended by the Department :—

No. 49 Yellow grain of medium size and erect habit of growth.

No. 52 A perfectly erect variety, grain of medium size, yellow.

No. 53 Grain of medium size, white.

No. 57 Earliest erect variety, grain yellow or brown.

No. 58 Late, black seed, spreading type variety.

Rabi varieties sown in Central Provinces are not common but two of them are popular. Their yield compared with the Kharif varieties is very low.

Yellow Adhartal—Big grain, yellow colour.

Manchuria—Big grain, black colour.

Manuring and Irrigation.—It being a leguminous crop requires less of manure; but it responds well to better manurial treatments. On the Nagpur Farm twelve cart loads of Farm Yard Manure are applied to Soya-bean lands every third year.

The crop, being hardy, can stand conditions of draught and does not require much of soil water for its growth. But two irrigations—one just after germination and one at the flowering stage have given the best results.

Basal Cultivation.—Cultivation given to the land, is the same as for Kharif crop i. e. Cotton or Jowar. The land should be ploughed to a depth of 8" in the winter and allowed to lie in a rough state until spring, when a second ploughing is given. Thorough cultivation and harrowing are then advisable to form a good seed bed prior to sowing.

Sowing.—The dwarf growing varieties may be sown in drills 2' 6", increasing the distance to 4' in tall kinds like Biloxi. A 3' 6" spacing with plants 8″—10″ apart will require about 16 lbs of seed per acre. On the Nagpur Farm, the seed-rate varies according as the crop is meant for fodder or grain. The grain variety is sown 18″ from line to line and 6″ to 9″ from plant to plant, requiring about 24 lbs of seed. In the fodder crop, the spacing is 9″ to 12″ from line to line and 6″ to 9″ from plant requiring about 40 lbs of seed per acre. It is sown mostly by Argada or sometimes with drills. Rabi crop is sown with the Tiffen, as used for gram. Sowing in C. P. is done just after cotton sowing and starts somewhere in June or July. It occupies the land for about four months and is harvested in the month of November. This year it was sown at the Nagpur Farm on the 17th June 1938 and was harvested from 2nd to 5th November 1938. The usual inter-row cultivation is necessary to check weed-growth and maintain a surface mulch.

Harvesting.—Harvesting is usually effected with a mower or side delivery harvester. For hay purposes, the crop is cut before the seed is mature and handled in the same manner as cow pea hay to preserve the leaf. Where the seed is the main consideration, cutting is delayed until the beans approach maturity but it takes place before any shelling-out occurs. When carting to the thresher, wagons are lined with bagsheets or tarpaulins to minimize loss. The yields of the Kharif crop obtained on the Nagpur farm during 1938—39 were as follows :—

No.	Yield.
49	1488 lbs.
52	1248 ,,
53	1488 ,,
57	960 ,,
59	1632 ,,

The yields of the Rabi crop are very low.

Yellow Adhartal	250 lbs.
Manchuria	300 ,,

The fodder value of the plant, in well grown samples, equals that of Lucerne. The tall growing varieties, Biloxi and Otootan have given the best results for hay and fodder purposes, the former possessing strong erect growth carrying dense foliage and reaching to a height of over 5 feet on the richer soils in Queensland. An average crop, from an acre of land gives 40 % grain and 60 % fodder.

Cost of cultivation on the Nagpur Farm 38-39.

Rs.	A.	P.	
17	8	6	Labour charges.
1	3	3	24 lbs of seed at the rate of 20 lbs. a rupee.
7	0	0	Establishment charges.
25	11	9	

Price of 1200 lbs. of seed at the rate of 20 lbs. a rupee—Rs. 60. So nett profit per acre is Rs. 34-4-3.

Use as Human Food.—It is as a valuable addition to our every day diet that Soya-beans are likely to be mostly utilized. Soya-flour containing approximately 40% protein, 20% fat, valuable phosphates and Potassium, together with the important vitamins A, B and D, is the best obtainable vegetable substitute for meat. In the chief producing countries, Manchuria, China and Japan, it is an esteemed article of diet, forming the basis of various food preparations. In Japan Soya-milk is made, the analysis of which compares favourably with cow's milk.

Owing to the high fat contents some difficulty was experienced in making a flour that would keep sufficiently long. This difficulty has been overcome by the "Berizellers" process, which produces a satisfactory flour that will keep.

Comparison of Soya, Wheat and Oats.

Food	Water	Protein	Fat	Carbo-hydrate	Fibre	Ash.
Wheaten flour	13.37	10.21	0.84	74.71	0.29	0.48
Oat-meal	9.65	13.44	6.92	67.01	1.86	2.12
Soya-flour	8.33	42.84	20.00	19.35	4.79	4.69

Illustrating calories per lb.

Food	Protein	Fat	Carbo-hydrate	Water	Calories per 1 lb.
Soya-flour	42.0	20.0	24.0	9.0	2165
Wheat	12.2	1.7	73.7	10.6	1750
Eggs	14.8	10.5	—	73.7	720

This flour contains four times as much fat as wheaten flour. This opens great possibilities for its mixture with wheaten flour for bread making in order to produce a more nutritive loaf.

Other uses and industrial future.—In ancient days in China, the rich bean oils were used for lighting homes, for water proofing, making the paper and cloth fabric transparent. The Soya-bean vine also replenished the soil. After a worn-out field bore Soya-beans for a few seasons, it once more bore its full quota of wheat or millet. Obviously, such a plant deserved divine reverence.

The properties of Soya-bean recorded by the Chinese Emperor are now being verified in scientific laboratories and the powerage technicians of the past thirty years have discovered close to 1000 uses for Soya-bean products in industry alone.

The promise of the "little honourable plant's" industrial future lies in two things—oil and protein. It is the protein which gives a pound of Soya-bean the nutritive value of more than 2 lbs of beef-steak, more than 2 quarts of milk. It is this quality which fattens hogs and beef cattle; strengthens farm work animals, and has enabled the Chinese for fifty centuries to live in health and vigour on a meatless and milkless diet.

But there is more in it than mere protein richness. Soya-bean protein presses into a firm dry plastic cake-oil mixed for certain industrial purposes. By the laboratory technicians, it has been discovered that this cake has all the plastic composition elements for which industry is constantly on the look-out. Though it is porous and light, yet it can easily be made wet-proof and practically indestructible by temperature changes and weather conditions. It develops enormous tensile strength and breakage resistance, when fused with proper cohesive materials. It insulates against electricity, only a little less efficiently than rubber. It is used with more inflamable materials, as a base material for candles, yet in some combinations it is virtually fire-proof.

There are no limits to the uses of this plastic with all these adaptable qualities. To-day Soya-bean meal goes into billiard balls and radio accessories, into axle-grease, and doll and toy composition, into buttons, cigarette-holders, glues and hair pins. The weather proofing and insulating properties of Soya-bean meal are the answer to the motor car manufacturer's prayer for cheap material since the automobile is essentially a small, weather-exposed house, built over a net-work of electrical connections. Thus when we drive away with our new 1939 model, the chances are that we will turn on our own lights with Soya-bean meal switch, look at our guages on a Soya-bean dash board, have our power-flow controlled for us by a Soya-bean timing-gear and look for wire "trouble" under Soya-bean distributor fixtures. It is believed by experts that the day is not far distant when Soya-bean compositions will play an important part in automobile body construction.

Meanwhile in the competition for industrial usefulness, the Soya-bean oils run a neck to neck race with the Soya-bean plastics. The water-proofing property which ancient China's Catch-as-Catch can industrial chemistry discovered, has been utilized and reinforced in modern laboratories until to day Soya-bean oil enters into scores of synthetic and substitute rubber products. The oil too, has the vegetable kingdom's high resistance to light effects and weathering processes.

Soya-bean oil, in a revolutionary wave, has invaded the paint industry. Soya-bean paints, varnishes and enamels hold their colours, even in the supreme weather list to which they are subjected on automobile bodies. Other properties of the oil, give it an equal entry into the "Heavy industries" where it is used as a base oil for foundry cores, a rust-proofing fluid. Its efficient soluble qualities are putting it increasingly in demand among the soap manufacturers, and a high glycerine yield gives it a place in the high explosive traffic.

These developments of "Soya-bean revolution" are matters of only yesterday's history. Down to 1917 the Soya-bean was hardly more than an exotic Oriental stranger but shortages brought on it by the war gave this valuable plant its chance.

How big the "little honourable plant's" future business will be is up to the laboratory technicians and play of the 20th century economic forces.

Slowly but surely, Soya-bean is establishing itself as the long-needed direct trade article between the farm and the factory, enabling the industry to buy from the farmer on the scale on which the farmer would like to buy motor cars and the comforts and luxuries of life, from industry. Deftly but efficiently the fifth "Sacred grain" of ancient China is performing its most complex miracle,—hooking the cogs of farm and factory economy to the same gear-shift.

However, in view of the plant's high nutritive value as a food stuff, as a fodder for stock, as a soil renovator in crop rotations, and its multifarious usefulness in industry, no excuse is needed for drawing the attention of our farming community to its potential possibilities.

APPENDIX

Economics of fertilisers in manurial and varietal experiment conducted at the Kheri Farm, Jubbulpore, during 1938—39.

(Continued from Vol. XIV Nos. 1 and 2)

S. No.	Name of variety of wheat	Treatments	Outturn per acre in lbs.	Extra yield over control in lbs.	Value of extra yield. Wheat @ 35 lbs. a rupee	Cost of fertilisers	Profit or Loss
1	AO 90	(1) 15 lbs. Nitrogen in form of Nicifos II ...	896	304	8 11 0	7 5 0	(+) 1 6 0
		(2) 15 lbs. Nitrogen in form of Ammonium Sulphate ...	728	136	3 14 3	4 8 3	(−) 0 10 0
		(3) No fertiliser (Control) ...	592	...	...	...	...
2	A 115	(1) 15 lbs. Nitrogen in form of Nicifos II ...	912	400	11 6 9	7 5 0	(+) 4 1 9
		(2) 15 lbs. Nitrogen in form of Ammonium Sulphate ...	680	168	4 12 9	4 8 3	(+) 0 4 6
		(3) No fertiliser ...	512	...	...	...	...
3	Pusa 4	(1) 15 lbs. Nitrogen in form of Nicifos II ...	786	288	8 3 6	7 5 0	(+) 0 14 6
		(2) 15 lbs. Nitrogen in form of Ammonium Sulphate ...	592	112	3 3 3	4 8 3	(−) 1 5 0
		(3) No fertiliser ...	480	...	...	...	...
4	Pusa 52	(1) 15 lbs. Nitrogen in form of Nicifos II ...	832	216	6 2 9	7 5 0	(−) 1 2 3
		(2) 15 lbs. Nitrogen in form of Ammonium Sulphate ...	684	68	1 15 0	4 8 3	(−) 2 9 3
		(3) No fertiliser ...	616	...	...	...	...
5	Pusa 101	(1) 15 lbs. Nitrogen in form of Nicifos II ...	824	312	8 14 6	7 5 0	(+) 1 9 6
		(2) 15 lbs. Nitrogen in form of Ammoninm Sulphate ...	712	200	5 11 6	4 8 3	(+) 1 3 3
		(3) No fertiliser ...	512	...	...	...	...

Extracts

IMPROVEMENT IN THE WHEAT CROP OF THE CENTRAL PROVINCES

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Area and Distribution.—Wheat is one of the most important staple crops of the Central Provinces and Berar, which stands third in the wheat growing Provinces of India, occupying some 3.4 million acres, representing about 15 percent of the gross cropped area of the Province and about 10 percent of the total area under wheat in India.

Share of important Provinces and States in acreage of wheat in India is represented in Figure I, and Figure II (page B) shows the distribution of area under wheat in the important districts of the Central Provinces and Berar. Wheat growing is mostly concentrated in the Saugor, Jubbulpore, Hoshangabad and Chhindwara districts of the Province. In the Saugor district it occupies nearly 48% of the gross cropped area, in Hoshangabad 33%, Jubbulpore 30%, Chhindwara and Betul 21 to 22%, Mandla 16% and 12% to 14% in the Wardha and the Nagpur districts.

Soil, Climate and Method of Cultivation.—Most of the wheat in the Central Provinces is grown on the regar or black cotton soils where there is heavier rainfall and lower winter temperature. The Nurbada Alluvium which stretches from near Jubbulpore in the east to Hoshangabad in the west is the principal wheat tract of the Province. Rainfall is the heaviest at the eastern end of the tract being nearly 50″ to 60″ and decreases west-wards ranging between 45″ to 50″ at Hoshangabad.

In the eastern section, called the Haveli tract the land is heavily embanked and lies under water during most of the monsoon and a short time before the sowing period, the bunds are cut and water allowed to run off, and when the soil is workable, the seed is drilled with a *Nari* plough in the middle of October without any preliminary ploughing or preparation whatever. The Haveli tract of the Jubbulpore district and the Narsinghpur sub-division embraces an area of over 300,000 acres. This system is also to be found in some parts of the Saugor district. But as one passes to the west of this tract the fields become open and the cultivation normal, called the Open Cultivation. The practice of growing wheat, gram mixture—called *Birra* is more pronounced in the Haveli tract of the Jubbulpore district and the Narsinghpur sub-division where the area under wheat gram mixture are over 1·5 and 2·5 times the area under pure wheat alone respectively. On the other hand in the Saugor district the wheat gram mixture forms only 1/6th part of the area grown with wheat alone. The proportion of gram to wheat varies from 5 to 50% depending upon the soil and the tract.

Distribution of wheat varieties.—As one of the most important cereals wheat engaged the attention of the Department of Agriculture from very early years. The work was seriously taken up by Mr. Evans in 1908 and has been continued.

The first essential step towards the improvement of the crop was a survey of wheat varieties which were then grown in the Province, mostly as mixture. Two main types of wheat grown are those which belong to the Vulgare and Durum species, with a sprinkling of others such as Triticum Dicoccum, the Emmer wheat *Khapli* and Triticum Compactum, the Dhania or *Jondhri*. Triticum vulgare are the common wheats—pissi or bread wheats, and Triticum Durum, the hard or Macaroni wheats.

About two thirds of the wheat crop of the Province falls under the Vulgare type. It is almost extensively cultivated in the dense wheat zone in the North of the Central Provinces. Soft white *pissi* is the chief variety grown in the Upper Nurbada Valley and in the Saugor and Jubbulpore districts and the Seoni sub-division. The Raipur pissi and other hard pissis are to be found in some parts of the Raipur, Bilaspur, Drug and Balaghat districts.

The important kinds of the Durums or the Macaroni wheats are the Houra of the Nagpur-Wardha plain with a trade name of "Nagpur Yellow", *Kathia* which is very generally distributed all over the Province, *Jalalia* which is restricted to a small area in the Hoshangabad, Seoni and Harda Tahsils of the Hoshangabad district with a trade name of "Khandwa Yellow" and the *Bansi* wheat which is particularly found in some parts of Berar, Hoshangabad and Balaghat districts.

These varieties differ widely in their botanical and commercial characteristics and have a soil and climatic requirements of their own.

Enemies of the Crop.—Rusts are the most important diseases of the crop, causing great loss to the cultivators, so much so that in years of heavy occurrence of rust, the wheat gathered that season may not be equal to the quantity of seed that had been sown. The great rust years were 1892-95, 1911-12 and 1927-28-29. Occurrence of frost in the northern districts of the Province is another curse. Severe frost had occurred in the north of the Province in the year 1929 which was followed by rust. Hail storms occur in some parts of the Province usually while the wheat is ripening or during the harvesting operation and cause considerable damage. During the wheat season of 1938-39 considerable damage was done by hail storms in the Sihora tahsil of the Jubbulpore district and in the Mandla district, so much so that in certain villages the cultivators did not care to harvest the crop at all.

Improved wheats of the Department.—The importance of the improvement in the wheat crop will be apparent from what has been said above. The desirable characters in a wheat variety are high yielding power, rust resistance, good standing power, a well marked tendency to hold the grain after ripening and a high quality grain as indicated by its strength. Certain tracts also require early maturing type. Principal results of the work of the department are the evolution of a number of improved varieties, some of which are detailed below.

A013 and A085.—These are the selections from *Sukerhai Pissi*, a soft bearded wheat. These are good quality soft white wheats which do very well in dry years but are very liable to bad damage by rust. A085 is slightly earlier than A013 and its grain has a whiter colour. A013 is probably the most heavy yielding wheat in the Province, chiefly grown in Hoshangabad district in the Nurbada valley. A085 is extensively grown in Betul on the high lying light soils.

A088.—It is a soft *Pissi* wheat, a selection from a local beardless wheat *Muria*, with some rust resistance power compared to local mixed wheats, mostly grown in Jubbulpore, Patan, Sihora and some parts of Narsinghpur tahsil.

A049 and A068.—These are the selections from the earlier generation of *Muria*, *Khapli* crosses. These are soft white wheats, A068 being harder than A049 and A013, partially rust resistant and early maturing, more suited to the hill tracts like Seoni, Mandla and Chhindwara.

A112, A113 and A115.—These are the "*Sharbati*" wheats of the tract and are sister strains as a result of crossing between *Muria* and *Khapli*. A115 is, however, liked most on account of a higher out-turn. The chief qualities of those wheats are that they are more rust resistant, as was proved in the rust years 1927-28-29, beyond doubt, when they were almost the economic salvation of the cultivators who grew them. They have a hard yellow grain, which fetches a more premium than any first class "Pissi" wheat and have a good tillering capacity and strength of straw. They are general purpose wheats, which do well under all conditions, of the wheat tract but under draughty conditions their yield is comparatively low.

A090.—It is a selection from *Lal-Kusarwala* of Punjab, has a high tillering habit and is specially suited for embanked lands and does well on light soils under irrigation. It is slightly heavy cropper than A115 especially in the bunded fields, is rather late in maturity and partially rust resistant. The grain is medium hard and is classed under "Sharbati" like that of A115 and A113.

Pusa wheats.—Some of the Pusa wheats are also becoming popular in some tracts of this Province, such as, P. 100 in the Chhatisgarh division, P. 101, P. 52 and P. 2 in the Jubbulpore district and P. 4 which is an awnless medium wheat, earliest in maturity is particularly suited for double cropping after rice.

Punjab 8-A is also found to fare well under irrigation both at Saugor and Hoshangabad.

The Department has also on hand the improvement of the Durum wheats. No. 116 a selection from Houra has done best at Raipur and Nagpur compared to other selections No. 11 and No. 82.

Crosses between local wheats and Pusa types like P. 4 and P. 52 and with Australian and Palestine wheats are also obtained with a view to meet the requirement of the different tracts. Some of them appear to be promising.

While some progress is made in the improvement of the wheat crop of the Province, the problem is by no means completely solved. The Haveli tract, plateau districts, the Nagpur Wardha plain and the black cotton soils with smaller rainfall, each have the problems peculiar to the conditions obtaining in them and the efforts of the department are directed to solve the needs of the different tracts. The scheme for wheat breeding for the black cotton soil tracts of the Province has been recently approved by the Imperial Council of Agricultural Research. The area under improved wheats in this Province represents only 16 percent of the total wheat area in the Province while in the Punjab and the United Provinces the proportion is 36 and 32 percent respectively. Side by side with the genetical and plant breeding work, agronomic work, such as trials of different varieties of the crop, methods of sowing, spacings to be given, effect of manures and fertilizers on the yield and quality of crop, rotation, cultivation, irrigation experiments, use of labour saving devices in sowing, threshing and winnowing of the crop etc. are being conducted at the experimental farms and these trials are extended on seed and demonstration farms distributed in the Province.

The Economics and Marketing section of the Department is taking steps in bringing about improvements in the marketing of the crop by introducing grading, standardisation of weights and measures and stopping of malpractices. The cultivators have begun to realise the value of growing pure varieties of wheat free from admixture and fully appreciate the price differences in respect of the quality of the crop.

With an attack on all fronts it is hoped that a considerable improvement in the wheat crop of this Province will be effected by no distant date.

(Originally published in Marathi in the Special Wheat Number of the "Udyam" Magazine).

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FARMING AS A PROFESSION

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It has almost become a fashion for arm-chair politicians, mostly wedded to town life, to give advice on public platforms and through newspapers, to the present-day young men, called the educated unemployed, to engage themselves in rural reconstruction and to go back to land; but it is well to realise that compared to other walks of life, agriculture is not a paying concern. There are several causes for this;

i. First and foremost, the growth of crops in India depends so much on the Monsoons, not merely on the total amount of rainfall in a season or in a year, but on the number of days over which the rainfall is distributed through the agricultural year. Very often both the Monsoons are uncertain; either they fail altogether or bring about a deluge.

ii. The major portion of land in India have been cropped without adequate manuring for generations and centuries, that the lands have come to their minimum cropping values. The exhaustion of the soil is rapid and has been constantly going on, but the building up of soil fertility and coaxing the soil to yield more crops is a very slow process. The building up of soil fertility and the production of a better yield of crops from the lands now under cultivation, are now being attended to by agricultural experts, though we must admit that India has got to make a great headway, yet, before intensive farming can be said to have

been established, on the scale attained in some other countries of the world.

iii. The assessment of land is felt to be a great hardship by the cultivator. One-sixth of the yield of a crop was due to the State in olden days as land revenue in a majority of cases, the present assessment is much more than the original quota of one-sixth. Land is liable to re-settlement and re-assessment, and in any case, re-settlement means an increase in assessment and is often based on the demands for expenses of administration rather than on the capacity of the cultivator to pay.

Fourthly the cost of cultivation is much greater now than it was in olden days: and, if intensive cultivation is to be adopted in future, implying as it does, better culti ation, better seed, better manuring and so on, the cost of cultivation will become much higher.

Fifthly, the prices of agricultural produce have become so variable. The crops produced by the poor Indian cultivator with his wooden plough and small cattle have to compete in the world market with similar crops grown on an extensive scale on scientific principles and with heavy machinery. Economic depression of the world connotes economic depression of India as well; and when countries adopt protective tariffs and deflated currencies, it is difficult for the poor Indian ryots to compete with the capitalists abroad.

The hopeful side of farming as a profession.— We have so far spoken of the adverse side of the profession of farming. There are also brighter sides. While an agriculturist cannot make colossal fortunes which magnates in the financial world or some successful lawyers can make, he can rest assured of a sure and steady income, though small, provided he adopts improved methods of cultivation in all aspects. A healthy life is ensured to the agriculturist, as also a considerable amount of independence which is lacking in several other professions. When richer harvests are obtained in the villages and when village uplift in all directions has been attended to, there will be less exodus of villagers to towns, and the village will then be a pleasant place to live in. In this important work of taking up intensive farming and re-constructing the village, it is the duty of the educated man to find ways and means of bringing about the desired results for his own benefit as well as for the welfare of the village folk. The mere fact of a young man having received some education in the English Language has not made him, after all, a higher caste man or a better man than the villager.

That the educated man is unfit to take up farming as a profession, we are not prepared to grant. He may be unwilling or unaccustomed to the work, but, in our opinion, he is not unfit. He may be unwilling,

because he does not want to exert and wants to idle away his time or to get on with a soft job. He may be unaccustomed to manual work, but he can learn when he earnestly appealed himself to the work—just as the Jew expelled from German University had to learn when he settled in Palestine and he will do well to remember that the country demands his services in all walks of life and that one who does no work has no business to expect that some one else will feed him. We must however, assert that he is perfectly fit, because he eats, on the whole, much better and more nutritious food than a villager. After all, physical energy is judged by the quality of food eaten and its calorific value.

While intensive farming, which means the production of more crops and better crops from the land than we are now getting always requires constant attention, there is one other aspect which deserves equal attention, namely extensive farming, in other words, the utilisation of lands which are culturable but are now kept waste.

Waste and Current Fallow:—According to the Agricultural Statistics of India for the year 1934—35, India contains 668 million acres, of which 89 millions are covered by forests and 155 millions are unsuitable, and therefore, not avilable for cultivation. 227 million acres form the net area sown during the year, of which 50 millions are irrigated from all sources, including wells. 52 million acres, once assigned for cultivation, have been left uncultivated during the year and have remained as Current Fallow. 154 million acres are classified as Culturable Waste other than Fallow. In other words, 206 million acres are cultivable but not cultivated.

Taking the Madras Presidency alone, out of a total area of 91 million acres, 13 millions are covered by forests and nearly 20 millions are unsuitable for cultivation. 33 million acres are shown as having been sown during the year, of which 9 millions have been irrigated. 11 million acres of assigned land are classified as Current Fallow, while the area shown as Culturable Waste other than Fallow, amounts to 13 million acres. In other words, 24 million acres out of a total area of 91 millions are cultivable but not cultivated.

In countries other than India, with a scale of population similar to India, this phenomenon of non-utilisation of such vast areas of culturable waste-land will be hard to imagine. The population of India increases during every decade, nearly doubling itself, in about 60 years. Food and clothing are required for the constantly increasing population; and it is, therefore, essential that, in addition to intensive farming of the existing areas of cultivation, additional lands must be taken up and brought under the plough.

There are a number of points, which require consideration with respect to the areas classified as culturable waste other than fallow. It is stated by some Revenue officers that the figures quoted in the Agricultural Statistics of India are not quite correct and do not represent the real state of affairs. It is necessary to examine this statement in some detail.

A certain amount of accuracy may be claimed for the net area sown, because assessment has been levied on each acre of this area, and Jamabandi officers can be trusted not to overlook any such assessment. Current Fallow represents assessed land, but not cultivated during the year, for one reason or another, and statistics with regard to this heading may also be presumed to be correct. The area under Forests has, in some provinces, been taken to include areas under Forest Panchayats, while in others, it is only restricted to Reserve Forests. On the whole, the statistics under Forests may be considered to be approximately correct. A considerable amount of uncertainty exists round the figures returned as not available for cultivation and as Culturable Waste other than Fallow. The area not available for cultivation is said to include land absolutely barren and unculturable or covered by buildings and waterways, cart tracks and roads, village *porambokes* or land otherwise appropriated to uses other than agriculture. Culturable waste land other than Fallow is defined as land available for cultivation but not taken up or abandoned.

Whatever may be the degree of accuracy with which these statistics have been calculated and classified, there must be a considerable percentage of these lands classified as Culturable Waste and Current Fallow, which can be brought under cultivation. Again, there may be some good virgin land out of this Waste and Fallow, but we may presume that they are not as good for cultivation as the lands already taken up. They may be rocky or swampy: they may be unhealthy tracts for human livings to live in, or may be land subjected to ravages of wild animals; they may be sparsely populated and may require an import of labour from outside; they may be inaccessible and would involve the laying of roads; and most important of all, they may have only a scanty rainfall or may lack means of irrigation. These several factors may not exist in one particular locality but, from the fact that they have not so far been taken up, the presumption is that there are difficulties in the way of bringing them under cultivation.

Assuming that there are extensive areas of land available for cultivation in spite of possible in accuracies in the Government Agricultural Statistics, a number of points require elaborate consideration; and we

summarise these points below and solicit constructive criticisms from the public :—

Points for consideration.—i. Whether the present rules for the disposal of land, as are explained in the Standing Orders of the Board of Revenue, are sufficient ; or whether these rules require modification in the Scheme of Colonisation we have in view ; and if so, in what directions have the rules to be modified?

ii. Seeing that Revenue Officers very often classify unassessed waste lands as Culturable Waste, what are the measures to be taken to ensure the accurate preparation of statistics of land which are actually cultivable; to what extent have the Revenue Officers to get co-operation in this work from Officers of other Departments like the Agricultural ?

iii. How far can the Honorary services of retired officers be utilised for this purpose ?

iv. Whether it is possible to organise efficient Village Panchayats to help in the scheme ?

v. Whether it is possible to afford initial financial help to the new colonists in bringing waste-lands into cultivation ? To what extent can the present Co-operative Agencies help in financing these Schemes, by organising Agricultural Co-operative Banks ? Whether the working of the Land Mortgage Banks can be adjusted to meet the needs of the Colonists ? Or whether a Special Colonisation Fund, whose sole object will be the financing of new Agricultural Colonies, may be established by Government ?

vi. How far can the provisions of the present Land Improvement and Agricultural Loans Acts and Takkavi Loans in general, be expanded to meet the needs of the new Colonies ?

vii. What particular areas of these waste lands would be suitable for arable cultivation, i. e., the growing of food, industrial or fodder crops ; what areas might be reserved for grazing, with a view to the rearing of livestock, chiefly, cattle, sheep and goats ; and what areas might be ear-marked for the growth of fruit trees or fuel trees and other purposes ?

viii. Whether there are facilities for irrigation and whether well-sinking will be easy and profitable ? What proportion of the areas of waste-land would admit of Dry Farming ?

ix. Whether the lands are to be permanently assigned to the Colonists and if so, on what terms ? When should the first assessment of land-revenue be levied and what should be the rate of assessment in the beginning, until the Colonies are well-established ?

x. Whether the lands can be permanently sold to the Colonists; if so how to determine the value of the land and in how many instalments, spread over how many years, should the sale price of the land be paid?

xi. Whether the waste lands are to be assigned to persons called the educated-unemployed, or to the villagers or to both in joint tenancy or in the relationship of landlord and tenant? What should be the exact relationship between the assignee, the tenant and the labourer?

xii. What measures have to be undertaken by Government, when there is need for the protection of the Colonies from malaria infestation, if any, or from the ravages of wild animals?

xiii. To what extent can the several departments of Government co-ordinate in their efforts the difficult task of Colonisation?

These are some of the problems which confront us, and there are more points yet for detailed consideration. They cannot be solved by one single individual or by one Department. Not less than a dozen articles will be required if we have to discuss each point in detail. Our immediate object is to attract the attention of the Government and the public towards the utilisation of waste-lands, as a measure of relief of unemployment.

The Royal Commission on Agriculture, of which His Excellency the Marquis of Linlithgow was the Chairman, has particularly stressed the point that while every Departmental Officer, who toured in the villages, did his duty conscientiously, there was very often an absence of co-ordination of work amongst officers of different Departments, as a result of which little progress was made towards rural uplift. Unless Rural Re-construction work is organised all along the line and provision is made for the continuation of co-ordinated work, no tangible results can be obtained.

Either for want of capital on the part of those capable of working the land, or for lack of the spirit of adventure on the part of those who have funds, the question of the utilisation of these waste lands has not been taken up until now. We do not want the Government to dole out charity. We only demand that facilities for work should be found for the unemployed population, both educated and uneducated. Let Government tackle the subject of Colonisation as a business proposition. It is easy for the Government to realise that the greater the area of land brought under cultivation, the greater will be their Land Revenue later on.

Actual Colonisation of particular tracts of land may be done step by step, confining work in the beginning to one or two districts. Difficulties will occur in all new undertakings, but they must be faced with courage,

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and it will be easy to carry on later, when experience has been gained in the initial stages of work. The work of Colonisation may have to be put into operation according to a well-defined, say, five-year plan.

Formation of a Colonisation Board.—The first step is for a competent Committee to discuss all the above-mentioned points and give a definite shape to the scheme. A Provincial Colonisation Board, purely advisory, consisting of officials, non-officials and retired officers may be formed, in the first instance, to discuss the problem in all its bearings and formulate what may be termed "The Colonisation Policy of the National Government." Local Committees may be appointed later on, when definite action is proposed to be taken. The experiences—successes and failures—in Colonisation as followed in other countries of the world, like the U. S. S. R., Germany, Denmark, United States, Palestine and the British Colonies and in Provinces like the Punjab are so numerous and instructive that we, cannot do adequate justice to them in this article, and they must be left to be considered and digested by the proposed Agricultural Colonisation Board.

There must necessarily be obstacles to all schemes of development. Such obstacles have occurred in the past in all countries and have been overcome. We have to visualise that the political India of to-day is not the same as it was seven years ago, although nowhere near complete independence which is the sacred creed of the Congress. Whoever dreamt a year ago that the Police Constable who dealt lathi blows would be the trusted servant of the Nationalist Ministry in the cause of prohibition? The outlook of the country is now very different from what it was even as late as last year. The simple living of the Khaddar-clad Congressmen and the spirit of service with which the new Ministry have agreed to serve the country by receiving low salaries and travelling 3rd class by railways, have appealed to the masses of India, who have now more than ever before absolute faith in the good intentions of the new Government and in their ability to translate such intentions into action.—(*The Hitavada*).

MECHANICAL REFRIGERATION

By D. McIvor (Lenswood).

Those people who have been sufficiently interested to give any thought to the subject are familiar with the phenomenon of the conversion of heat into work, as exemplified in the steam engine and in other heat engines. The operation of the refrigerating machine may best be described as the direct opposite of that process, namely, the conversion of work into heat in such a way as to result in the production of cold. One of the most remarkable things about refrigeration is the fact that in order to produce cold, heat must be expended. The explanation is really very simple. The first law of thermo-dynamics tells us that both heat and work or mechanical energy are mutually convertible, and the second and this is the important point that heat cannot be raised from a lower to a higher level of temperature (this is to say, cannot pass from a cold body to a hot body) without the expenditure of some external energy. Owing to a confusion of the meaning of the two terms "heat" and "cold" and of the origin of heat, cold is often in error spoken of as if it were some substance complete in itself. Cold is merely an absence of heat, and people should not speak of "allowing cold to escape" when they mean "allowing heat to enter." The production of a state of cold consists entirely in depriving a body of its heat. It is consequently necessary, in order to conform with the second law of thermo-dynamics, to expend external energy, and it will be found that the great bulk of modern refrigerating machines consist of a heat pump, driven by a steam engine, an oil engine, a gas engine, or an electric motor. As water is always trying to find its own level, so heat is always endeavouring to balance itself, and when once a substance is cooled or refrigerated it will tend to absorb heat from some warmer substance, until its temperature is again that of its surroundings.

The term refrigeration suggests that the reduction in temperature of a body should be maintained as well as originated, and to effect this it is necessary by means of some medium which is capable of absorbing heat to keep on pumping the heat out of the body to be kept cool as fast as it flows in. Pumping heat is perhaps an unusual expression, but it is the principle underlying refrigeration. The heat absorbed from the cold body is raised by a compressor or pump to a higher level of temperature that is to say, to a temperature higher than the normal temperature of some substance that will, while in its natural condition, receive heat from it.

In practice this substance is always water, which is circulated around pipes or over coils containing the heated medium. By this means an exchange of temperature takes place, the heat tends to equalize itself, and the water becomes warmed while the medium becomes cooled.

Refrigerating machines may be roughly divided into two classes:—

(1) Machines which use air aid are practically obsolete; and

(2) Those which use some chemical agent having a low boiling point and which produce their refrigerating effect by alternately condensing and vaporizing this agent with the aid of a compressor or heat pump.

Ammonia at atmospheric pressure becomes liquid at a temperature of 30° F. Before it can be turned from a gas into a liquid it has to be robbed of its latent heat, and it naturally follows that if its latent heat is restored to it will again boil and again become a gas.

In boiling it will absorb heat from any substance that may be near it, and on being compressed the gas will in its turn deliver up the heat so absorbed to the cooling water trickling over the condenser and again become a liquid.

Assuming that the machine is using ammonia, the gas from the refrigerator and expansion coils is drawn into the compressor; on the return stroke of the compressor piston the gas is compressed and driven to the condenser. The ammonia gas in the suction pipe is at a pressure of about 27 lbs. per square inch, and at a temperature of 14° F. It contains the heat which has been absorbed from the atmosphere in the cold chamber, and which was necessary to turn the ammonia to a gas. By being compressed this gas is decreased in bulk, and the heat contained in it is so to speak concentrated, so that the gas in the pipe leading to the condenser is at a temperature much above the temperature of cold water.

The condenser has cold water trickling over it; this water is at a temperature of approximately 60° F. and absorbs the heat from the gas in the coils and carries it away. The gas, robbed of its heat, can no longer remain a gas, and becomes liquid in the same way that steam if cooled will condense. Though a liquid it is obvious that the ammonia will be ready to start boiling and again turn to a gas as soon as the pressure upon it is relieved. This is done by passing it through a small opening in the expansion valve. When the ammonia has passed through this valve it starts boiling and drops many degrees in temperature. Before it can boil, however, it must absorb heat, and as 1 lb. ammonia requires at atmospheric pressure 589·3 heat units before it can turn into a gas, these heat units have to be abstracted from the substance

surrounding the expansion coils, which as a result rapidly become covered with snow. It will be seen that the cycle of operation consists of three parts:—

1. Compression or reduction in volume and increase in temperature.
2. Condensing or giving up heat and liquefying.
3. Evaporating (boiling) or absorbing heat and so gasifying.

It is apparent that if the liquid ammonia is constantly fed into the expansion coils through the valve and the gas drawn away by the compressor a great amount of heat will be absorbed by the boiling ammonia in the coils, and if these coils are placed in an insulated chamber that chamber will be reduced in temperature or refrigerated. The ammonia is used over and over again, and if it were possible to make the plant leak-proof no more ammonia would need to be added, as ammonia is said not to deteriorate when used in a refrigeration plant. However, as the glands and joints are not always gas-tight a certain amount of loss is going on, even though it cannot be detected. This loss is reckoned to be between 10 lb. to 20 lb. per ton of refrigeration per year.

From time immemorial the orchardist and the engineer have not been always able to agree on the correct temperature for the storage of fruit. The engineer has only two things to take care of, that is, temperature and humidity; whereas the grower has perhaps dozens of different things that affect the keeping qualities of the fruit. The success of any steps which are taken to preserve fruit depends much more on the knowledge of the fruit grower and packer, assisted by the scientist, than it does on the refrigerator engineer and architect. Until the growers have made up their minds to be guided in the kind and quality of the fruit they grow, the way they grow it, the time they pick it and put it into cold store, and the way in which they pack it, the refrigeration engineer, even if he designs a perfect installation, cannot hope to achieve complete success, because he will be dealing with an imperfect article, imperfectly grown, imperfectly harvested, and imperfectly packed.

It will be useful at this point to discuss briefly the chemical changes which fruit undergoes when ripening and how the regulation of temperature can affect it. The fruit which has been most studied is the apple, and investigations have shown that the disintegration of the carbo-hydrates in the process of ripening involves, by respiration, the production of CO_2. The more rapid the respiration the quicker the time of ripening and the shorter the time of keeping and conversely the slower the rate of respiration the larger the time of keeping When the fruit is picked from the tree its life processes do not stop. On the contrary, at

ordinary temperatures, they continue as rapidly, or possibly even more rapidly, than before. The function of cold storage is primarily to retard these life processes. Its purpose is also to retard and prevent the germination of spores of fungi which cause the fruit to decay and to prevent the development of skin blomishes. For this purpose a temperature of between 31° and 32° F. is considered standard for the apple. No temperature, however, which will not seriously injure the fruit by freezing can entirely check its ripening processes or the growth of all fungi which cause decay. It is obvious, therefore, that fruit allowed to become over-ripe prior to storage can never re-gain in cold storage the quality it has lost. Neither can cold storage prevent the final decay of fruit already infected with decay fungi. Since cultivation and handling methods largely determine the condition of the fruit when it is stored, the first responsibility for its successful storage lies with the grower. The individual growers should study their own fruit and their own conditions, and whenever possible they should make experiments to determine the stage of maturity at which the varieties they grow hold best in storage. The colour of the seeds gives some indication, yet in spite of many opinions to the contrary it is an unreliable index to the maturity of the fruit. Many factors may cause the colour of the seeds to vary without affecting materially the time at which the fruit reaches full maturity.

The blush or red colour of the apple taken by itself also is unreliable. Both of these factors should be taken into consideration, however, perhaps the most reliable single indication is the "ground" colour of the fruit; that is, the colour which underlies the red colour or blush.

The "ground" colour, which is green when the fruit is immature, begins to whiten or yellow slightly as it approaches full maturity. As a rule in a mature apple the green colour should be largely replaced by a white or light yellow colour. A dark yellow, on the other hand, usually indicates over-maturity. Allowances, of course, should be made for the natural colour of the variety, the amount of exposure to sunlight, etc. Experience will enable a grower to give the proper weight to each one of these factors and properly to co-ordinate them.

The factors governing the keeping of apples in cold storage in the order in which they occur may be summarized from the various authorities as follows :—

(a) **Variety.**—This should be the result of careful selection, having regard to locality, soil and conditions. Some varieties are more liable to scald than others.

(b) **Orchard practice.**—As the uncoloured and therefore immature portion of an apple is peculiarly liable to scald, and as a high colour is important for market reasons, it is very necessary to prune the trees to admit light and air into the interior to evenly ripen and colour the fruit.

(c) **Harvesting.**—Scald is the commonest form of damage and cause of break-down. The skin of the fruit browns and blackens as if it had been scalded. The flesh under the skin is not affected in the first instance. "Brown heart" is the term used to describe the brown and dead tissue in the flesh of the apple under the skin. Scald is external or a "skin disease." Brown heart "is an internal or a flesh disease". "Bitter pit" is similar in type to "Brown heart," but occurs on the growing apple generally under the skin.

Scald is due to :—

(a) **Immaturity.**—One side of an apple may be mature, the other green or immature; the immature side will scald. Apples harvested early are, for this reason, peculiarly susceptible with late harvesting, and more mature fruit scald is comparatively slight.

(b) **Time of storage.**—Apples put into cold storage immediately after harvesting are much less liable to scald and decay than those kept for a fortnight or so in ordinary temperatures. Even a few days in the orchard or packing house may greatly shorten their cold storage life from decay especially if the weather is warm. Few factors are of greater importance, and apples stored immediately after picking have held in cold storage in good condition one month longer than the same apples which were kept at ordinary temperatures before being stored.

It has been stated that a temperature of between 31° and 32° F. is generally recognized as the best for commercial storage; but as the characteristics of different varieties of apples vary, it is obvious that when one species may preponderate it might be of advantage to adjust the storage temperature to suit.

Thus the Food Investigation Board has found experimentally that for Bramley's Seedling a temperature rather over 34° will probably have to be recommended, and a temperature 36° or 37° for King Pippin apples, though in the case of Newton Wonders progressively better results were obtained to lower the temperature down to 30° below which of course there is a danger of frost. Apples which have been cold stored are found to be subject to troubles peculiarly their own, such, for instance, as bitter pit, black rot, scald and brown heart. Bitter pit is believed to be due to some action, climatic or otherwise, which interferes with the normal breathing and growth of the fruit, and so

causes a temporary and harmful excess of CO_2 in the interior flesh cells, producing what is really local brown heart. In New Zealand it has been found that when the normal growth of the fruit has been retarded by drought and very hot weather and a vigorous growth produced by rain follows, the apples have been bodily affected with bitter pit. The Food Investigation Board has arrived at the conclusion that while 33·8° is the correct storage temperature, below a storage temperature of about 37° losses are almost entirely confined to physical surroundings, and above that temperature losses are almost wholly due to infection by moulds.

In the Journal of Agricultural Research it is stated that ripe apples are less subject to bitter pit and black rot than apples which are immature, and that apples from well irrigated soils are more subject to rot than apples grown on drier soils. The Food Investigation Board states that apples grown on clay soils keep better than those grown on chalk, and those on chalk better than those on fen land. Growers should realize that cold storage will help them to hold their fruit in sound condition, until the market can absorb it, but they must realise that it can only do this if they are prepared to take some trouble to see that the fruit is in good condition when it is put into the cold store. That is the grower's part of the job, and if he does it he can safely leave the rest to the refrigeration engineer. (*Journal of Agriculture of South Australia*).

AGRICULTURAL COLONISATION IN THE PUNJAB

Rao Bahadur M. R. Ramaswami Sivan

The Punjab Government appointed some years ago a Special Colonisation Officer, a senior I.C.S. officer for 5 or 6 years and later a senior officer of the Provincial Service. *Correct information* was obtained about the actual areas of land suitable for cultivation and available for assignment, in samll or big blocks and in old villages and new colonies. Rules were framed for the assignment of land, by sale or on lease, for different purposes, e.g., for cultivation, for house building or for construction of markets, and to different classes of people, capitalists, yeomen, camel-chaudris, mule-breeders, village headmen, military pensioners, peasants and literates, and applications were called for. A few capitalists purchased lands in auction but the bulk of the land was assigned on temporary lease, usually for 20 years with the proviso, that when the lands were properly cultivated and the new colonies were kept sanitary to the satisfaction of the Deputy Commissioner, he may, any time after 5 years, grant permanent occupancy rights to the lessees.

Peasant Holdings.—I was able to see some of the lands cultivated by small peasant cultivators, who had usually been assigned comparatively small areas, less than a half a square or 12½ acres, and they were a happy and contented lot altogether.

Large Estates.—About a dozen large estates had been assigned to retired officers. I was not able to see the estate at Khanewal of Mr. Roberts, late Principal of the Lyallpur Agricultural College, to whom 7,500 acres of land were said to have been leased out for supplying improved strain of cotton seed to the Department, but I was able to visit the estates of Mr. Bansford, late Superintendent of the Hissar Cattle Farm and of Col. Bruce, to each of whom more than 3,000 acres of land had been assigned, in return for their obligation to supply a specified number of well-bred mules every year to the Military Department.

I was, however, more interested in the experiment of Colonisation by University Graduates, about which I had heard from my friend Chan Bahadur Fatehuddin, Deputy Director, Jullundur and through whose kindness I had read some literature on the subject. The genesis of the Colonisation by the educated unemployed is worth notice. As far as I can gather from some published records to which I had access, the idea of settling Agricultural graduates on land emanated from Mr. Johnstone, Professor of Agriculture and Mr. F. W. Stewart, the then Principal of the Agricultural College, Lyallpur, as early as 1924. Owing to the sympathetic and prompt action of Mr. Milne, the then Director of Agriculture, and, acting on the memorial of the Lyallpur Agricultural College Old Boys' Association and on the recommendations of a Special Committee which included the late Sir Ganga Ram, the Punjab Government awarded a grant of 3,500 acres of land at Shergarh to the Principal of the Agricultural College for being assigned, at his discretion, to select passed students of the College, at the rate of 75 acres each, on a lease for 5 years.

Subsequently the matter came up for further review why the scheme should be restricted to Agricultural Graduates and whether unemployed Arts and Science Graduates could not also be benefited by the scheme. Considerable amount of correspondence delayed the launching of the Colonisation Scheme at Shergarh. It was not until 1931, that a definite policy came to be adopted, and this was due to the late Sir Fazli Hussain, then member of the Punjab Executive Council. In his visits to European Countries, Sir Fazli Hussain seems to have been much impressed with the high standard of life displayed in small farms in Switzerland and France and, realising that such standard could be

developed in Indian Villages only if educated men went to live in villages, he set about giving practical shape to the long-thought of scheme for such Colonisation.

The Punjab Government decided to give a trial to the experiment of diverting all classes of educated unemployed to land, and the Principals of the Colleges at Lahore and Lyallpur were asked to select the firs Colonists in the year 1932. The selection was as follows:—

Government College, Lahore	...	7
Foreman Christian College, Lahore	...	7
Dyal Singh College, Lahore	...	7
Sanatan Dharm College, Lahore	...	7
D. A. V. College, Lahore	...	7
Islamiah College, Lahore	...	9
Agricultural College, Lyallpur	...	4
Total	...	48

The list includes one LL.B., one M.B.B.S., and one Graduate of the Punjab Veterinary College.

As the Colonisation of land by the University Graduates of the Punjab will be an eye-opener to graduates in other Provinces, I am taking the liberty of writing my impressions of the Graduate-Grantee-Chaks in some detail.

Graduate-Grantee-Chaks in the Punjab:—As stated in paragraph 11, the Principals of Colleges selected 48 candidates out of a large number of applicants in 1932 and they were distributed in two Colonies called, (i) Graduate-Grantee-Chak No. 649-B, Gogra Branch and (ii) Graduate-Grantee-Chak No. 689—G.B., Toh. Tobe Tek Singh. Two Agricultural Graduates were told off to each Chak. Each grantee was allotted 2 squares or 50 kilas of land (1 kila=1⅛ acre). Blocks of 2 squares separated by a kucha road, 16½ feet wide, were laid out on the outskirts of the colony as the fields of cultivation, all irrigable from the lower end of one of the Chenab Canals. Within the fields, blocks of half an acre were assigned to each colonist, separated by wider roads, for building houses. In the centre of these house-building sites, a considerable area had been ear-marked as the village-common, where play-grounds for the children had been provided and a decent Panchayat house had been built with a carefully laid-out park all round. An additional area of 3 squares of land had been allotted for municipal amenities and for meeting the expenses of maintaining the village-common.

It is a condition of the grant that the land should be cultivated by the tenants themselves, aided by paid labour, if necessary, but not by sub-tenants. It was made plain to them from the beginning that they were not offered a completely equipped village, but on the other hand, there were no habitations, no drinking water beyond the distant canal, and no amenities or marketing facilities, that the Colonists must be prepared to suffer the usual hardships of all pioneers and that they must bring the requisite capital to purchase cattle and other needs of cultivation. The colonists must pay the regular assessment and water rates, from which they were excused in the first year of their occupation like every other new colonist. Apart from the grant of three squares to provide for municipal amenities, the opening of a Post Office and the general help and guidance given by officers of different Departments from time to time, the graduate colonists depend entirely on their own resources. At the time of my visit, each Chak had an elementary school for boys and girls and a Village Dispensary, whose expenses have hitherto been met from the Common Good Fund, but I was informed that they would be taken over later on by the District Board.

The graduates came to these desolate places with a spirit of adventure and a certain amount of uncertainty, both about their own fitness to do manual work and about their making sufficient income to lead a comfortable life, at least of the standard to which they had been accustomed during their College days. Five years' experience has brought them a cheer and a confidence in themselves and they are looking forward to more successful years in future.

(i) The experiences of Risaval Singh of Chak No. 694-B are detailed hereunder as a representative case. He is a native of Lyallpur District, passed B. Sc. Ag., from the Lyallpur Agricultural College, was in temporary service in the Department for 3 years, when he was retrenched, joined Chak in 1932, when he was 29 years of age and brought Rs. 2,000 as an advance from home. As a result of 5 years' working, he has repaid the advance of Rs. 2,000, has built a pucka house worth Rs. 4,000 and his live-stock and dead-stock worth Rs. 2,000 besides having maintained his family consisting of himself, his wife, his father and mother, his younger brother and 2 or 3 children.

The house is a terraced-brick building, containing six rooms in the living portion. Provision is made in his compound for one store room, one cattle-shed for 16 animals, 2 rooms for permanent coolies, one tube-well for drinking water and gardening, and also a shed for storage of straw and roughage. A neat and useful vegetable and flower garden is maintained. There is also a compost pit in a corner, apart from a movable four-screen lavatory.

His live-stock consists of six strong working bullocks, 3 Delhi she-buffaloes, 2 Montgomary cows and six young stock—all in *excellent condition.*

The dead-stock includes a three-roller sugar mill, a country-cart, 2 furrow-turning ploughs, one cotton sowing drill and 6 ploughs, besides spades, bill-hooks, crowbars, sickles, baskets and gunnies.

As regards labour, the lands are worked by himself, his father, and younger brother and by 2 permanent servants who are paid Rs. 100 per annum, besides food estimated to cost Rs. 80 per annum. Occasional cooly labour is employed for picking cotton and harvesting grain, and they are paid either in cash or in kind. When paid in kind, the rate varies from 1 in 16 to 1 in 20. The amount incurred on casual cooly labour during the previous year was Rs. 275.

Cropping Scheme.—Out of his holding of 50 kilas, only 40 kilas, were cultivated during the previous year. 14 kilas were under wheat, 12 kilas under cotton, 3 kilas under Toria, 1½ kilas under sugar cane 3 kilas under Bengal gram and 6½ kilas under fodder. The Bengal gram was a failure in the last season, but wheat, cotton, jaggery and Toria realised a total income of Rs. 2,690. The fodder was fed to cattle and no valuation was made for it.

Land assessment and water rate amounted to Rs. 460 per annum. His net income during the last five years varied from Rs. 100 to 150 per mensem, depending largely on the prevailing prices of wheat and cotton in the market.

He is hopeful of bringing the entire area under cultivation and adopting more intensive farming in future years, and will not care to accept a Government job hereafter.

(ii) The case of Sher Mohammed Hamid, M. A. (Econs.), from the Government College, Lahore, whose original home was in Ambala District, is that he invested only Rs. 800 in the beginning, and that he now owns a house worth Rs. 5,000 bigger and better furnished than that of Risaval Singh's. Besides owning live-stock and dead-stock on the same scale as Risaval Singh, he has a good stock of Leghorn poultry, maintains 4 permanent servants and has been following Risaval Singh in all matters of cultivation and has been getting an average income of not less than Rs. 100 for the last 5 years. Mr. Risaval Singh is considered the recognised Agricultural expert by all the other settlers.

(iii) The figures furnished by Hari Singh, B. Sc. Ag., belonging to Chak No 689-G. B. are even more elaborate. His total income for the ast season was Rs. 2,754 and the expenditure Rs. 1,800 showing an annual

net income of Rs. 950. The statement given by Mr. Hari Singh seems to be an under-estimate, for the reason that the original advance had been paid back, bigger houses have been built, same number of live-stock and dead-stock are maintained and there are no outstanding debts.

(iv) The general impression left on me by a visit to these Graduate-Grantee-Chaks was that, with a certain amount of guidance on the part of Officers of different Departments and serious willingness to work on the part of the colonists, Arts and Science graduates will turn out to be good practical farmers, exactly in the same manner as the Jewish University students expelled from Germany settled down in Palestine.—*(Reprinted from a leaflet)*.

INDIAN SUGAR INDUSTRY

Annual Review.—Imports of sugar have considerably fallen according to the Review of the Sugar Industry in India for the crop year ending October 31, 1938 just issued.

A drastic curtailment of the acreage—of which, however, 75 per cent was under improved varieties—and lower production, were among other features of the year.

It may be noted that Java more than doubled its cane acreage and output and number of factories working in 1937. The acreage in 1937 was 211,788 compared with only 85,076, output 11,915,314 tons compared with 4,640,856 tons, and number of factories working 81 compared with only 35 in 1936. The total production of sugar was 1,414,500 metric tons. The first cost quotation for superior Java white sugar, for ports in the west coast of India was about Rs. 3/- per maund in January and February 1937, but by December 1937 it had risen to Rs. 3-12 per maund. The average price of best Indian cane sugar in November 1937 was Rs. 6-13 per maund.

Indian peak year.—The peak of Indian acreage under cane, output of sugar and 'gur' was reached in November-October 1936-37. Over-production of sugar resulted in low sugar prices. Minimum cane prices being fixed every fort-night according to average price of sugar, the cultivators received very low prices. Therefore the acreage under cane was drastically curtailed and fell by over 14 per cent in 1937-38; besides the crop was poor owing to diseases, floods and insect pests. The scarcity of cane compelled factories to close early. The production of cane sugar in 1937-38 was over 16 per cent less than in 1936-37, and prices of sugar which were generally low in the beginning of the season improved towards its end. The recovery of sugar from cane was low on account of the poor quality of the cane.

The world production of sugar in 1937-38, however, was greater by 0.6 per cent than in 1936-37 while the world consumption was about 2.6 per cent less, resulting in a considerable rise in the ratio of world stocks to world consumption on August 31, 1938.

The area under cane in India in the crop year 1937-38 was 3,943,000 acres, 14 per cent less than in 1936-37 but 10 per cent above the average for the previous five years. About 75 per cent was under improved varieties of cane and 25 per cent under indigenous.

The total output of cane in India was 55,637,000 tons, a decrease of over 17 per cent; this production expressed in terms of 'gur' amounts to 5,452,000 tons a decline of 19 per cent.

Sugar and Gur.—The number of cane factories fell from 137 to 136 and that of refineries rose from 9 to 10. The total production of sugar was 1,072,200 tons compared with 1,237,000 tons in 1936-37. Cane sugar factories produced 930,700 tons compared with 1,111,400 tons, refineries 16,600 tons compared with 19,500 tons, and Khandsaris 125,000 tons compared with 100,000 tons in 1936-37. The total output of molasses was 483,000 tons compared with 521,000 tons in 1936-37. Of this cane sugar factories contributed 349,600 tons refineries 8,000 tons and Khandsaris 125,000 tons. The total net production of gur was 3,364,000 tons compared with 4,268,000 tons in 1936-37.

The recovery of sugar from cane was 9.38 per cent compared with 9.50 per cent in 1936-37 due to low recovery in the United Provinces, in parts of which the cane was of poor quality owing to severe damage by floods, diseases and pests. The recovery for the United Provinces was 9.18 per cent compared with 9.65 per cent in 1936-37. Recoveries increased in all other provinces being 9.58 per cent in Bihar and 9.77 per cent for provinces other than the United Provinces and Bihar compared with 9.20 per cent and 9.60 per cent respectively in 1936-37.

The total revenue from excise in 1937-38 was Rs. 3,30,96,902/- on white sugar and Rs. 50,427/- on Khandsari sugar compared with Rs. 2,52,01,965/- and Rs. 47,411/- in 1936-37.

Sugar Machinery worth Rs. 69,86,183/- was imported into India in 1937-38 against Rs. 95,16,462/- in 1936-37.

Imports and exports.—Exports of Indian sugar by sea amounted to 14,296 tons in the official year 1937-38 compared with only 521 tons in 1936-37. Exports by land were 33,100 tons compared with 30,100 tons in 1936-37 and re-exports 1,686 tons compared with 9,095 tons in 1936-37. Exports of molasses and cane jaggery by sea amounted to 79,167 tons compared with 24,195 tons in 1936-37.

The amount of foreign sugar imported into India in the official year 1937-38 was 13,715 tons compared with 23,100 tons in 1936-37, Java sugar falling to 10,293 tons from 15,020 tons. Imports of confectionery, exclusive of Jams and Jellies amounted to 1,387 tons compared with 1,857 tons, and of saccharine 25,721 lbs. compared with 23,241 lbs. in 1936-37.

Consumption.—The per capita consumption of sugar varies widely from province to province, being over 16 lbs. per year in Bombay and Punjab and less than 3 lbs. in Madras. The per capita consumption in India was 7.3 lbs. per year in 1936-37. The estimated consumption in the crop year 1937-38 was 1,150,000 tons compared with 1,167,000 tons in 1936-37 and 1,074,000 tons in 1935-36.

The United Provinces and Bihar which together produce about 85 per cent of Indian Sugar, consume only about 16 per cent of it. They are the chief exporting provinces while Punjab, Bombay, Bengal and Madras import sugar. In the crop year 1936-37 the United Provinces exported 576,361 tons and Bihar 260,347 tons. Punjab, North West Frontier Province and Delhi together imported 249,613 tons, Bengal 173,075 tons, Bombay 200,608 tons and Madras 97,411 tons.

Gur is also exported from the United Provinces and Bihar mainly to Punjab and Bengal. In 1936-37 United Provinces exported 409,067 tons and Bihar 128,508 tons of gur; Punjab imported 147,433 tons and Bengal 132,067 tons.

Price improve.—The crop year 1937-38 opened with low prices for both sugar and gur. The average price of best Indian cane sugar and of Cawnpore special (a typical gur sugar) improved from Rs. 6-13 and Rs. 7-2 per maund in November 1937 to Rs. 9-4 and Rs. 9-9 per maund in October 1938, respectively.

The price of gur varies widely from market to market. In November 1937, gur prices varied from Rs. 2-4 per maund in Bhagaipur to Rs. 6-6 per maund in Dacca when the year closed they had risen to Rs. 4-11 per maund and Rs. 8-12 per maund respectively.

The world production of sugar in September-August 1937-38 was 30,991,000 tons, consumption 29,757,000 tons and stocks on August 31, 1938, 10,111,000 tons. The closing stocks thus were 34 per cent of the consumption against only 29 per cent on the corresponding date of the previous year.

SWEET TODDY

Researches carried out at the Haffkine Institute show sweet (unfermented) toddy to be a drink of unexpectedly remarkable nutritive value. It seems that this juice has never been adequately studied before. For this reason exact knowledge on the subject has been lacking and quite fallacious views have gained currency. It is proposed to indicate here, very briefly, some preliminary results of the present investigation.

Valuable Sugars.—The juice, fresh and unfermented, contains as much as 5 per cent of levulose and about the same amount of invert sugar. Levulose is a sugar of peculiar value. It is readily assimilated by the body. A normal person can take as much as half a pound of this sugar without raising even very slightly the level of this blood sugar. For this reason even the mild diabetics can use this sugar. There are very many other uses for it in medicine. Its supplies are rare and sell at somewhere from Rs. 15/- to Rs. 30/- a lb., depending on the degree of the purity of the samples. This most valuable sugar and the almost equally valuable invert sugar entirely disappear out of toddy on fermentation. It is possible to separate out this sugar out of the juice and use it as such. Methods are being worked out to make this commercially possible. Obviously it would be more profitable to prepare levulose out of sweet toddy, rather than convert it into cheap jaggery.

Vitamin C.—It is not generally known that sweet (unfermented) toddy has an exceedingly rich content of the anti-scorbutic vitamin. Workers at the Haffkine Institute find that the vitamin C. Content of some samples of sweet toddy almost equals the content of lemon juice, a fruit particularly rich in this vitamin. The importance that a large percentage of the people of India, including the well-to-do classes, suffer from the effects of deficiency of this vitamin. Types of ill-health resulting from a deficiency of this vitamin are protein. Bad teeth and affections of the spinal cord are attributed to lack of this vitamin. Only very gross deficiencies of this vitamin lead to scurvy. It is to be noted that this vitamin is of special value to women during pregnancy and lactation.

This vitamin is very readily destroyed by the usual methods of handling and cooking food stuffs containing this vitamin. Though most leafy vegetables contain this vitamin, major part of it is destroyed in 24 hours after the leaves have been plucked and kept exposed to atmospheric temperature. Cooking destroys the rest. Even ripe fruit begin to lose their vitamin rapidly. The result of all this is that people get very little of this very important vitamin. Therefore the discovery of a new, rich

and cheap source of this vitamin is a matter of considerable importance. But it is to be remembered that toddy also loses this vitamin rapidly when kept at room temperature in fermented or unfermented state. Special attention therefore has been paid to the preservation of this vitamin and will be referred to again lower down.

Vitamin B.—Most readers will remember having heard of this vitamin being talked about in connection with toddy. According to some doctors fermented toddy is a rich source of vitamin B. The truth of the matter is that both fermented and sweet 'toddy' contain only traces of vitamin B (anti-neuritic factor) and are not a rich source of this vitamin. The work carried out at the Haffkine Institute definitely shows that there is no ground for attributing any particular value to 'toddy' on account of its vitmin B content. And it may be stated here that vitamin B (anti-neuritic factor) is very widespread in nature and has been detected in almost all the natural food-stuffs. Among other food-stuffs, pulses, which are a common article of diet, are a particularly rich source of this vitamin.

Protein.—In addition to the sugars and vitamin sweet 'toddy' juice contains 0.5 per cent of good protein.

Changes on Fermentation.—To recapitulate fresh sweet 'toddy' contains 10 per cent of levulose and invert sugar, a small amount of valuable protein and very large quantities of vitamin C, making it a particularly valuable food and drink possessing exceptional health giving properties. When the juice is fermented and handled in the usual way the valuable sugars of the juice and its vitamins are destroyed and converted into vinegar and alcohol. It is not known to most people that absolutely uncontrolled process of fermentation to which the 'toddy' juice collected in a dirty manner is subjected in the country produces not only alcohol but also vinegar. Result is that the fermented 'toddy' as it is sold in the bazar is not an appetizing drink. Worse still its total vitamin C content is destroyed. Thus the juice ceases to have any food value at all.

Preservation of Sweet Toddy.—These studies make it clear that the properties of this exceptionally valuable juice have remained unknown and the only process to which the juice has usually been subjected is uncontrolled fermentation. This process destroys its nutrition value in toto. Government have been keenly interested in making available to the public this health giving drink with its nutritive value absolutely unimpaired. This problem was entrusted to the Haffkine Institute and I am glad to be able to say that methods have been worked out to achieve this.

It is well known that when the juice is collected in the ordinary way fermentation begins and proceeds rapidly. Therefore the studies had to cover both the problems of the collection of the juice and its subsequent preservation. The method or methods of preservation had to prevent the destruction of the very valuable sugars of the juice and their conversion into vinegar and alcohol, and also to preserve its vitamin C content unimpaired. Further the agent or agents used for such preservation had to be perfectly harmless to the body. Work at the Institute has evolved a method which meets all those requirements. Sweet 'toddy' preserved by this method retains its sugar and vitamin content absolutely intact for months and not even traces of alcohol form. What is more juice preserved in this way cannot be subsequently fermented. The juice, thus retains its valuable nutritive properties intact, and what is equally important, its natural fresh taste. A report on the method of preservation is being submitted to Government and it is hoped they will take up the collection and distribution of the sweet 'toddy' and thus make available to the public a drink of remarkable nutritive value.—*(The Sunday Amrita Bazar Patrika).*

THE GREAT RURAL AUDIT IN INDIA

The Agricultural Department of the Government of India has set itself to complete this task by mid-night January 31. Every day this month a gigantic stock-taking is in progress. In India's 700,000 villages agricultural officers are busy visiting one fifth of the human race in its homes, walking thousands of miles through the country-side, patiently addressing questions to a peasantry even more patient in thinking and giving tongue, jotting down replies; and so in the end, filling the hundred and odd columns required for compiling the 1940 census of Live-stock in India.

This Live-stock census runs a pretty close second to human census being concerned with counting a four-footed population which is 60 per cent of the human total and includes one-quarter of the worlds' entire stock of cattle and at least two-thirds of its buffaloes.

Horses, camels, mules, donkeys, goats, pigs and poultry are not excluded from this audit. They are all sorted out into gender, age and particular function in the country's agricultural economy. The 1930 census figures are as follows;

Cattle and buffaloes	...	...	187 million.
Sheep and goats	...	...	87 million.
Horses, mules and donkeys		...	4 million.
Camels ...	...	...	1½ million.

Arranged on even more scientific and tidy a plan than it's predecessors, the present census almost trebles the number of it's compartment for Live-stock sorting and now takes account of poultry and pigs. To take poultry alone, the census should produce some impressive figures for a feathered population hitherto uncounted. In comparison with world's figures, India's total of domestic fowls and ducks is not so striking, yet a conservative official guess is at 173 millions. Proper census figures would of course be necessary in an effort to rescue the poultry industry from its step-child position in the country side and make it a thriving cottage industry.

It is often stated that India's cattle are dwindling in numbers. That the opposite is the case is proved by census returns for the past twenty years, which record a small but steady increase. Indeed the number of cattle and buffaloes in India is still abnormally high for her population. There is roughly two-thirds of a bovine for every man, women and child.

Almost the only means of traction in the plains and fields of India is the bullock. But in the rice tracts and damp parts of the country the male buffalo shines as the farmer's friend.

"Queen of the dairy is not yet holy mother cow whose milk-giving powers are quoted oft by the pious. Here she has a competitor in the buffalo, whose bigger milk yield and higher percentage of butter fat has to be taken into account. But the poor man if he kept a buffalo would soon be eaten out of house and home. So poor people generaly keep goats rightly called the poor man's friend. However the day is not far distant when eager contingents of the "Viceroy's Bulls" despatched to the four corners of India, will have restored their pristine virtue to the farmer's cows and made cow-keeping a profitable thing for him.

Among sheep the 1935 census recorded a decline of one and half million.—*(The Illustrated Weekly of India).*

H. E. THE VICEROY'S VISIT TO THE MODEL FARM AT BARODA

An electric pick me up for plants, ultra-sized fruits and vegetables and various articles manufactured under Rural Co-operation were shown to Their Excellencies at the Model Farm. They were shown how electric energy was being infused into growing plants to ensure unhindered growth. It was explained that experiments had shown that electrical energy proved useful to plants only upto a certain stage, beyond which it had no good effect.

Their Excellencies were shown a large size grape fruit, Italian and Euraka lemons, Malta oranges, tomatoes (some weighing about two pounds) and Basrai banana, commonly known as Harichhal Kaila. The

fruit expert claimed that the day was not distant when this variety of bananas, train loads of which now went to Northern India from Khandesh and Bassein Districts of the Bombay Presidency, would be sent at competitive rates from Baroda State. The lemons were now being grown on a large scale in the State. Experiments had proved that this fruit, which now yielded only Rs. 44 per ton to the grower, could fetch him Rs. 600 per ton, if the juice were sold separately and the by-products were converted into pickles and other articles for human consumption.—*(The Times of India)*

MEDICINAL PLANTS IN HYDERABAD

In order to meet the demand that exists in the State for many of the herbs and drugs used in the preparation of Unani and Ayurvedic medicines, which are not at present available locally in a fresh and pure condition, the Agricultural Department of the Nizam's Government has undertaken certain experiments to ascertain which of the important medicinal plants can be grown successfully and in what types of soil. These experiments have been started with locally procurable seeds at the Himayatsagar, Sangareddi and Rudrur Agricultural Farms. Seeds of other medicinal plants, not locally obtainable, are also being secured in order to widen the scope of these experiments.—*(The Times of India)*.

THE PRICELESS SOIL

In " This is Our World," a book just published by the University of Oklahoma Press, Professor Paul B. Sears shows how the world of nature is continually making an effort toward balance, adjustment, and report, and it is up to man not to destroy his living environment or change is too greatly.

Soil, he says, is stuff that has been lived in and lived upon. " Soil covers the land surface nearly everywhere," he continues. " Therefore, it is common, vulgar stuff. On it falls everything dead, useless, rejected. It must be unclean.

" But it feeds us, and all life. In its seeming corruption is the tie that binds the endless generations into one. It surges with vitality. Against our contempt it can strike back with an invisible power more dreadful than that of ocean. Yet no domestic animal responds more completely to patient, intelligent, and loving care.

" Unlike the climate which goes its own way inexorably, take it or leave it, we can come to terms with the soil. For soil is above everything else a matter of collaboration. The impersonal forces of the

physical world here co-labor with the organisms which people this world. Of this joint work soil is the expression. Of the energy which earth receives and life utilizes, it is the great reservoir."

Those who conserve and guard the soil have a tremendous responsibility. It is not too much to conclude that, in the final analysis, the degree of intelligence with which soil husbandry is conducted, on farms next year and in the years to come, is the deciding factor in the future of our nation, our civilization, and of the human race itself.—(*The Furrow.*)

NICOTINE AND TOBACCO

Nicotine, which is a valuable insecticide, is produced in the United States principally from the waste of factories where tobacco is prepared for smoking.

Since nicotine is thus a by-product, American plant-breeders have directed their attention towards producing leaves of superior smoking quality.

Recently news came from Germany to the effect that tobacco plants containing an average of eight to ten per cent nicotine are being bred for the purpose of supplying the alkaloid and that occasional plants contain as much as 16 per cent of it.

These percentages are several times higher than those in ordinary tobaccos and compare with two to three per cent nicotine in American cigarette tobacco. Obviously one might not find this tobacco pleasant to smoke.—(*The Furrow.*)

GOVERNMENT AID

An Irish soldier in France during the Great War received a letter from his wife saying there wasn't an able-bodied man left, and she was going to dig the garden herself. Dan wrote at the beginning of his next letter: "Bridget, for heaven's sake, don't dig the garden; that's where the guns are."

The letter was duly censored, and in a short time a lorry load of men in Khaki arrived at Den's home and proceeded to dig the garden from end to end.

Bridget wrote in desperation, saying that she didn't know what to do, for the soldiers had dug up the garden.

Dan's reply was short and to the point—"Put in the spuds."—(*The Furrow.*)

College and Hostel News

The Annual Social Gathering of the present and past students was the notable event of the period under report. Owing to the difficulty of accommodation the holding of the function was almost impossible this year. But, thanks to the authorities of the Nagpur University who so kindly lent the University Hall for the purpose, and the encouragement given by Mr. J. F. Dastur, the then Principal of the College, the Social Gathering proved to be a great success.

The programme, began with the College Sports on the morning of 21st December in which a number of students took very keen interest.

In the evening of the same day after a group photograh was taken, the final match of the College Tennis Tournament was played between B. B. Bannerji (II year) and R. P. Jyotishi (III year) in which the former won after a good and interesting fight. The peculiar feature of this year was an exhibition doubles match between the staff and the students. The staff was well represented by Mr. J. F. Dastur and Rao Bahadur D. V. Bal, who with their respective speed and patience, showed how these qualities combine well against strong opponents. The match proved to be really a treat for the spectators, and also served very much in strengthening the good relations between the staff and the students.

The next evening Mr. P. M. Khareghat, Vice-Chairman, Imperial Council of Agricultural Research, who so kindly graced the occassion delivered an address to the students. He emphasized the co-ordination of different sciences for the purpose of a successful development of the agricultural industry of the country. After distribution of the prizes by the chief guest, an "At Home" followed, on the lawns of the Agricultural Research Institute.

LIST OF PRIZES AWARDED 1938-39

Final Year

1. Smythies Chemical Medal ...	Chemistry	... B. G. Ghawghawe
2. The Napier Essay Prize	... Essay	... M. V. Gokhale
3. Kedarnath Rai Prize	... Agricultural Engineering	R. K. Wadaskar
4. Special Prize	... Agriculture	... M. V. Gokhale
5. Special Prize	... Entomology	... M. C. Gangrade
6. Special Prize	... Botany	... D. G. Dakshindas
7. Special Prize	... Veterinary	... M. C. Gangrade

Third Year

8. Class Prize	... Best all round student	... G. R. Shirpurkar
9. Phatak's Prize	... Agriculture	... G. R. Shirpurkar
10. Kalidas Choudhari Medal ...	Practical Agriculture	... G. R. Shirpurkar

Second Year

11. Coronation Commemoration Prize...	Best all round student ...	B. L. Nema
12. Class Prize ...	Mathematics and Survey.	B. C. Pradhan
13. Class Prize ...	Elementary Science ...	B. L. Nema
14. Class Prize ...	Agriculture ...	B. L. Nema
15. Chakradeo Prize ...	Practical Agriculture ...	B. L. Nema

First Year

16. Special Prize ...	Best all round student ...	J. Hota
17. Class Prize ...	General Agriculture ...	J. Hota
18. Class Prize ...	Practical Agriculture ...	J. Hota
19. Class Prize ...	Mathematics and Survey	J. Hota

SPORTS PRIZES

1 Mile ...	1. R. S. Raghuwansi, 2. S. N. Sakalle
100 Yards ...	1. Trilochansingh, 2. C. M. Kekre
Long Jump ...	1. C. M. Kekre, 2. Trilochansingh
440 Yards ...	1. C. M. Kekre, 2. R. N. Meharanwar
Putting Shot ...	1. P. C. Verma, 2. Trilochansingh
High Jump ...	1. K. G. Bhide, 2. Trilochansingh
Sack Race ...	1. C. M. Kekre, 2. S. S. Tomar
880 Yards ...	1. A. D. Kane, 2. S. N. Sakalle
Throwing the cricket ball ...	1. Trilochansingh, 2. C. S. S. Mudaliar
Bullock Race ...	1. S. R. Palnetkar, 2. S. S. Tomar
Cock Fight	1. V. R. Deshmukh
Obstacle Race ...	1. Trilochansingh, 2. S. L. Patni
Ping Pong ...	1. S. A. Joshi, 2. C. M. Kekre
Carrom Singles ...	1. S. A. Joshi, 2. Ajit Singh
Auction Bridge ...	1. R. V. Gumasta and K. M. Singh
	2. S. L. Patni and S. A. Husain
Chess ...	1. Abdul Wali, 2. Asgharali Raja
Inter Class Relay Race ...	1. Second year 2. Fourth year Special Prize
,, Football ...	Fourth year
,, Hockey ...	Fourth year By Mr. R. L. Gupta
,, Volley ball ...	Third year
Tennis Championship ...	B. B. Banerji (Mrs. Churchill's Cup)
,, Runner up ...	R. P. Joytishi
,, Runners up ...	(Staff) R. B. D. V. Bal and Mr. J. F. Dastur
Championship ...	Trilochansingh

The following students are granted College Colour for this year.

Hockey : 1. S. N. Sakalle, 2. N. B. Gupta, 3. C. M. Kekre

Foot-ball : 1. V L. Golhar, 2. B. N. Lakhe, 3. A. K. Moharikar

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OBITUARY

We very much regret to record the sad dimise of V. N. Ranganatha Rao Esq. L. Ag. (Nagpur). He was for sometime Lecturer in Botany in this College. He was Assistant Botanist to the Government of Mysore for many years. Last year he was appointed as Economic Botanist to the Mysore Government. He was chiefly associated with cotton research in the State, to which he has made valuable contribution. Our heartfelt sympathies go to the members of his bereaved family.

Reviews

PLANT BREEDING TECHNIQUE IN RECENT YEARS

By R. H. Richharia, Ph. D.

(The Bangalore Press, Bangalore City). Pages 78 Price Rs. 2/8/-

The publication of this book has removed the long felt want of amatuer plant breeders and persons interested in the science of plant breeding who have neither the necessary background for understanding the subject nor the proper opportunities to learn the modern technique. It will also be of great use to students of agriculture and botany.

The Author has divided the book into 14 chapters describing the different aspects of plant breeding and vividly putting forth the importance of Cytological investigations in understanding the problems of plant breeding and genetics, especially by the non-mendelian methods. Chapters on Polyploidy, Haploidy, Decapitation and effect of Temperatures, Chemicals and Radiations, are particularly interesting.

Numerous diagrams and illustrations make the reading of the book more interesting. The get up of the book and printing are excellent.

R. J. K.

AGRICULTURE COLLEGE STUDENTS UNION MAGAZINE, CAWNPORE

This is a welcome companion to similar publications from the other Agriculture Colleges in India. Each province has its own agrarian and rural problems, and the best organ which can effectively deal with these is the Magazine emanating from that Province. The staff and students of a Provincial Agricultural College can do a lot of service to the agriculturists of the province by contributing illuminating articles on subjects of provincial interest. The first number of the above magazine, contains a number of useful articles of the above description. We wish the newly started magazine a glorious future.

WHEAT NUMBER OF THE "UDYAM"

Udyam's popularity has been well earned. It may not be incorrect to say that it is the only magazine in Marathi, which devotes its pages to various aspects of Indian welfare like, Industries, Agriculture etc. The present issue, called the Wheat Number, contains full and useful information on the cultivation, and marketing of wheat in this Province. A number of officers of the Department of Agriculture have enriched its pages with notes on certain aspects of the cultivation of wheat in the Province.

किसान ।

माधव प्रसाद श्रीवास्तव
प्रथम-वर्ष

खेत मध्य वह कौन वीर-सा
अविरल गति से चलता है ?
एक बड़े से हल के पीछे
चलकर क्या वह करता है ?
ग्रीष्म-दिवाकर प्रबल रश्मि-दल
सिर पर कैसा धमक रहा !
पद के नीचे तप्त-धरा का
पटल अग्नि-सा धधक रहा ॥
पिघल रहा तन बर्फ सरीखा
स्वेद नदी-सा बहता है ।
कर्म-क्षेत्र में अविचल होकर
हिम-गिरि-सा वह रहता है ॥
पैर झुलस जाते हैं तो भी
मुँह पर आह न लाता है ।
कर्म निभाने को ही केवल
योगी-सा बन जाता है ॥
पर योगी तो बैठे रहते
योग-साधना करते हैं ।
देश जाति की सेवा तजकर
अपनी मुक्ती करते है ॥
योगी से बढ़कर दिखता यह,
कर्म-क्षेत्र का वीर महान् ।
उमड़ रहा है इसके दिल में
देश, जाति का अति सम्मान ॥

है किसान यह, देश-उदरपोषण
　　का साधन करता है ।
देश, जाति को सुख पहुँचाने
　　कष्ट अनेकों सहता है ॥
कर उत्पन्न अन्न उपयोगी
　　देश, देश पहुँचाता है ।
यथा देह के अंग-अंग में,
　　हृदय रुधिर फैलाता है ॥
होवें यदि न किसान यहाँ
　　तो देश मृतक हो जावेगा ।
महलों से शोभित नगरी में
　　मरघट ही बन जावेगा ॥
दशा देखिए इन लोगों की
　　जिनपर सारा देश टिका ।
देश-शक्ति वर्द्धन करने में,
　　जिनका सारा माल बिका ॥
कहाँ गई सम्पति इनकी,
　　फूलों में मधु-सा वास किया ?
साहुकार भौंरों ने उनको
　　स्वार्थी होकर साफ़ किया ॥
अब मुरझाने लगे फूल ये
　　सुन्दरता भी चली गई ।
देख-देखकर दर्शक—गण भी,
　　घृणा दिखाने लगे नई ।
काला तन है यद्यपि इनका,
　　हृदय सरल औ' उज्ज्वल है ।
काले बादल के अंतर में
　　ज्यों संचित निर्मल जल है ॥

सोचो जरा दृष्टि भी डालो,
इनके दु:खमय जीवन पर ।
तोभी कर्मवीर है कैसे,
दु:ख न लाते है मन पर ॥
खाते है ये सूखे टुकड़े,
वे भी उदर नहीं भरते ।
कितने कृषक बिचारे प्रतिदिन,
यहाँ-वहाँ भूखे फिरते ॥
रहने को है छोटी कुटिया
घास फूस की बनी हुई ।
साहुकार की दृष्टि इसे भी
लेने को है लगी हुई ॥
इनके ही कर राज्य-कोष में
द्रव्य निरन्तर भरते है ।
विविध-विभागो के दीपों को
कृषक स्नेह-मय करते है ॥
पर केवल आश्चर्य यही है
'दीप-ज्योति' शहरों को है ।
'दीपक-तल' का सिर्फ अंधेरा
केवल इन कृषकों को है ॥
जीवन की अति कठिन पहेली
इनको भी सुलझाना है ।
इसी पहेली की उलझन में
फँसे हुए मर जाना है ॥
धन्य! अपूर्व त्याग यह इनका,
क्लेशों का करके आह्वान !
मातृ-भूमि की बेदी पर,
है करते जीवन का बलिदान !!

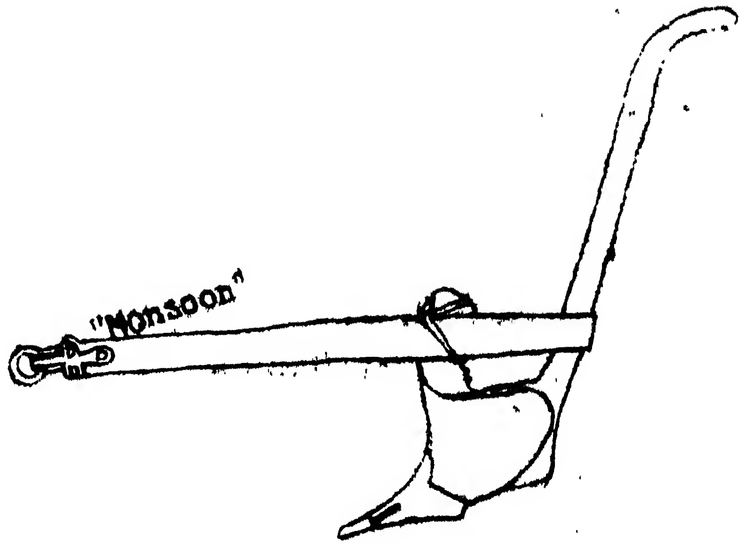

FIG. 1.—MONSOON PLOUGH (PAGE 58).

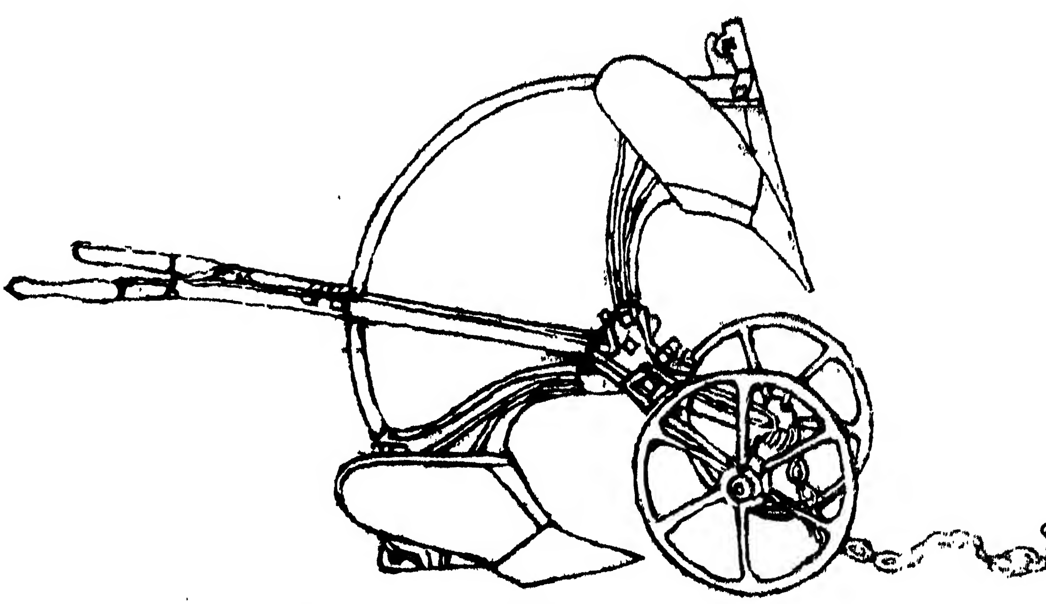

FIG. 2.—RANSOMES BALANCE ONE WAY PLOUGH (PAGE 58).

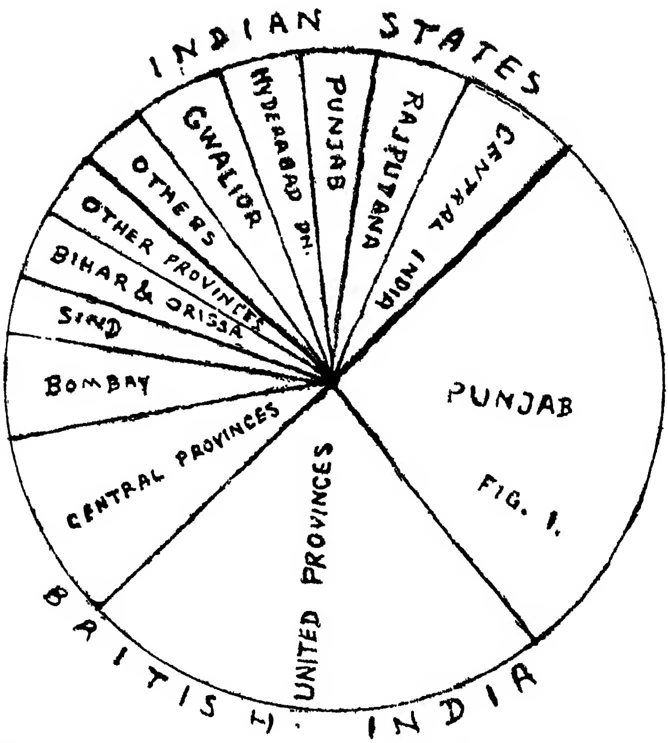

FIG. I.—Share of Important Provinces and States in acreage of wheat in India (Page 72).

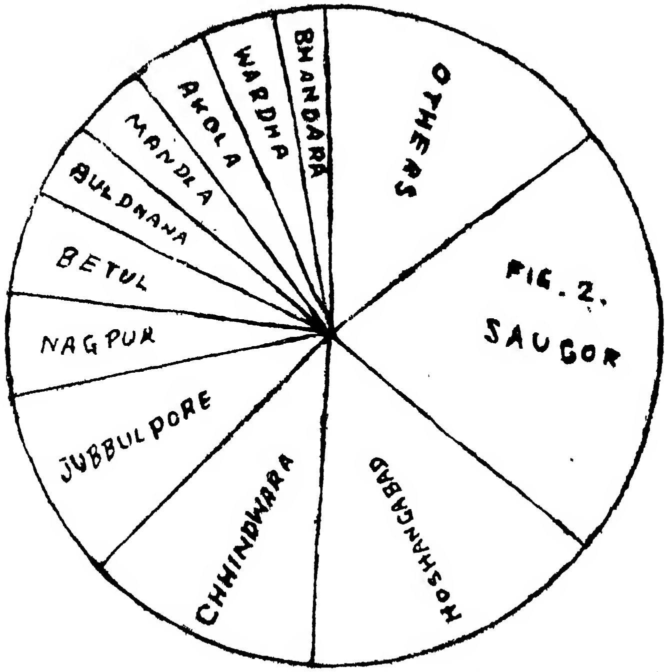

FIG. II. Distribution of Area under wheat in the important districts of the C. P. & Berar.

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The

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B[illegible]lanath—the detective bull.

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Editorial Notes

CONFERENCE OF AGRICULTURAL ECONOMISTS

A Conference of this kind was held for the first time at Delhi during February 1940 and from the impressions carried by those who attended the meetings the Conference seems to have been a great success. The discussions embraced several important problems affecting the Agricultural prosperity of the country. Such pooling of information from different Provinces on the all important problems like consolidation of holdings, land tenures, debt conciliation, cost accounting etc. will be a great asset to students of Agricultural Economics. We hope that in order to give greater publicity to the valuable information collected a complete report of the papers read and the discussions which took place will be published by the office-bearers of the Conference. We are glad to note that a paper on the recent Debt Legislation in C. P. and Berar, read by Mr. N. M. Joglekar, M. A., LL. B., Lecturer in Economics of this College was well received. We hope to publish this paper in the columns of this Magazine in the near future.

THE ALL INDIA CATTLE SHOW AT DELHI

Like its predecessors, the All India Cattle Show at Delhi this year (February 1940), was a great success. Fine specimens of cattle were sent from different parts of India to be exhibited. We congratulate Mr. Poonamchand and his colleagues of the Telankheri Co-operative Dairy for having shown their keen interest

in the All India Cattle Show by attending the cattle show and exhibiting some good animals bred at Telankheri. We hope that several agriculturists who own cattle of which they should certainly be proud will follow the example of the members of the Telankheri Co-operative Dairy by attending the All India Cattle Show at Delhi which will continue to be held every year.

DETECTIVE BULL

Nagpur had in bull Bholanath a visitor of rare description. The bull who is seven years old has been brought by its owner from Agra on a tour. Considering the wonderful powers possessed by the bull, we are sure that the tour will be a great financial success to its owner. The bull is an average sized animal and black in colour. Most of the body, including the face is kept covered by gaily decorated cloth, a large number of which have been presented to the bull by his admirers. The bull can identify persons from their names, from their professions, from their hobbies, etc. For instance in a demonstration gathering, Bholanath, identified the Principal of the College, botanists, chemists, policemen, musicians, barbers, etc. Articles like key bunches, hats, fountain pens etc. belonging to different persons were tied to his horn and Bholanath made no mistake in delivering the goods to the proper persons in the crowd. Bulls like Bholanath should prove very useful to the Criminal Investigation Departments like the dogs which are maintained by the Scotland Yard in England. If the sagacity which is shown by the bull is really an inborn quality, a subject worthy of investigation presents itself before genetists. We have great pleasure in publishing a photograph of Bholanath—the wonderful bull.

THE COLLEGE BUILDING

The Public Works Department has commenced the necessary repairs to the Victoria Technical Institute Building (the Agricultural College) which had to be vacated last year being declared unsafe for habitation, as one of the porches had fallen down and several cracks had formed in the arches. After the repairs the building will look slightly different from what it was

as the width of the arches on the ground-floor will be less than the original ones and the first floor will be completely removed and replaced by flat concrete slabs. We hope that, when the college re-opens on Friday the 14th June, at the rapid rate at which the repairs have commenced, the classes will not be required to meet under the mango trees of Maharajbagh, Room No. 25 of the College Hostel and the class rooms of the Colleges of Science and Law, very kindly lent by the authorities last session.

THE MUNICIPAL PAIL DEPOT

Water scarcity with which Nagpur is threatened this year has been a blessing in disguise to the Agriculture College Hostel and its surroundings. The Civil Station Sub-Committee in order to save water required for flushing the night soil in the Pail Depots, has been diverting all night soil carts to a smaller number of Pail Depots, thus closing down some. The Pail Depot regarding whose nuisance complaints have been made from the boarders and the staff of the College Hostel for the past several years with no effect, is fortunately for them, one among those which has been closed. We hope that the Civil Station authorities will kindly see that the Pail Depot adjoining the Agriculture College Hostel will never be used again.

Original Articles

TANK SILT FOR RICE CROP

Mr. N. K. Tiwari

(Agrl. Assistant, Balaghat, C. P.)

Indian soils at the present time suffer and owe their low state of fertility or ability to produce good crops to the fact that for many years, as Mr. Allan used to say 'the cultivator has been, as it were, dipping his hand in the bag, taking out the contents and returning little or none.'

Besides this we are now facing depressions as the agricultural produce is fetching the lowest prices, tillers of the soil are now finding it hard to make both ends meet. The only solution that can help them to

ameliorate their condition is to increase the outturns per acre and reduce the cost of cultivation to the minimum.

In order to achieve this object of getting more returns per acre, there is the necessity of having full control on irrigation and manure, so that in case of the former, the farmer may not be required to look to the sky for rains and in the case of the latter he may not run short of it, which is generally the case when intensive farming is also practised side by side; in order to maintain its adequate supply we have to find some cheap source of manure for rice crop which is grown extensively in this part of the Province. The most economical is tank silt.

In the rice tracts of the Central Provinces it has been observed that there are tanks in almost every village for the 'Nistar' of the people and in addition to this they provide drinking water to the village cattle. These tanks are generally situated in the low lying areas and the villages are on a higher level. During rains the village washings are collected and deposited in these tanks. Year after year this process is repeated by Nature and we observe that these tanks which used to hold several feet of water before during the hottest part of the year are seen dry as they are now full to the brim with the constant deposits of village washings, leaves and other green weeds which grow and perish year after year.

Analysis.—A perusal of the details of analysis of a few representative samples of tank silt obtained from this Tahsil and analysed by the Agricultural Chemist to Government, Central Provinces would show that the most useful ingredients required by the plants, are present in tank silt.

Samples	Organic Nitrogen %	Nitrate Nitrogen %	Total P_2O_5 %	Available P_2O_5%	Organic Matter %	Lime %
(A) Kumhari Kala ...	0.133	0.003	0.105	0.014	2.420	0.184
(B) Kumhari Khurd...	0.413	0 0004	0.112	0.038	3.50	0.248
(C) Lanji ...	0.55	...	0.09	...	...	...
				Other details were not worked out.		

The other food materials besides Nitrogen are also of equally great value as they play an important part in enriching the soil in some way or the other and improving its physical condition and raising crop yield.

Trials.—The continuous dressing of the tank silt @ 20 cart loads (5 Mds. per cart load) per acre for a period of 4 years on the Government Demonstration Plot KHAM in Jubbulpore Distt. has given the outturn to the extent of 3370 lbs. of Paddy No. 17 per acre.

Similarly the use of tank silt which was also demonstrated on the Government Demonstration Plot KATANGI in Balaghat Distt. by me during the year 1938-39 has given the highest yield of 2457 lbs. of Luchai Paddy per acre, since the opening of the plot in 1924—25.

Recently tank silt was tried by Mr. V. N. Kelkar, B. Ag. (Poona), Malguzar of Mouza.—Kumahari Kalan in Balaghat Distt. on his private demonstration plot and his results are as under. Manured with tank silt @ 12 cart loads per acre=1152 lbs. paddy; un-manured=875 lbs. paddy.

This plot of 8.68 acres was manured with tank silt viz. sample A and the total manurial ingredients are as follows:—

1.	Organic N	= 327.8	lbs.
2.	Nitrate N	8.0	,,
3.	P_2O_5	258.8	,,
4.	Lime	453.376	,,
5.	Organic matter	5962.88	,,

Total cost of manuring this area with this tank silt came to Rs. 30/-.

Total units per Rupee = 233

On Nitrogen Basis ,, = 11

Net profit per acre = 3/8/- Although sample A is the poorest of all as shown in the Table, yet it has paid its way. The richer samples give better results.

In case of other manures (organic and inorganic) the cost over unit of Nitrogen was as under at the Government Demonstration Plot, Katangi.

Name.	N. %	P_2O_5	Cost of 100 lbs	Cost per unit Nitrogen.	Rate.
1. Sulphate of Ammonia.	20	...	6/4/-	-/5/-	7/- per Cwt.
2. Castor Cake ...	5.60	2.00	2/5/-	-/6/6	1/14/- per Md.
3. F. Y. M. ...	0.4	0.3	-/4/-	-/10/-	1/- per cartload
4. Tank silt ...	0.55	0.09	-/-/6	-/-/10 or -/1/-	-/2/- ,,

Thus it is clear from the above data that tank silt is the cheapest manure. Besides Nitrogen, the main required ingredient, the silt contains a number of other nutrients viz. Phosphoric acid and Lime to the extent of 258.8 and 453.37 lbs. respectively as per para V, which were automatically added along with Nitrogen. They play an important part in not only improving the land but also increasing the yield per acre of grain and straw and also leaving increased crop residues.

Conclusion.—Farm Yard Manure is becoming so scarce and expensive these days that even a prosperous cultivator is not able to use it for the rice crop except for nurseries. The fertilizer rates are also rising rapidly, and an average cultivator cannot afford to get better returns unless he manures his crops properly and adequately. The cheap and easily available manure is 'tank silt'. It has given high yields with minimum expense and the crops grown with this manure, have been found to resist the attacks of insect pests and other diseases, due to their quick growth and strong vitality.

Thanks are due to the Deputy Director of Agriculture, Southern Circle, C. P. and Berar for approving the manurial treatment of the Government Plot Crops at Katangi during 1938-39 with tank silt and affording facility of the demonstration in this tract.

"THE INDIAN AGRICULTURIST—A RETROSPECT AND PROSPECT"

MR. D. R. DHODAPKAR, M. Sc., B. Ag.

A look at the map of India will give us a clear idea of the vast range of its extent. The vastness of the area includes in its sphere various combinations of ecological and soil factors thus enhancing the possibilities of the cultivation of a large number of crops. The large number of rivers running across the land in various directions, in addition to their being the natural drains, serve also as irrigation reservoirs. This makes the higher type of agriculture easily possible. But it is really a sad irony of fate that with the vast amount of natural resources and advantages at command, the tiller of the soil leads a life but little different from his ancestors. Not only this but the past experience shows that he has had to pass under such critical conditions that but for his lowest standard of living, it was hard for him even to survive.

This leads us to the conclusion that either there was a lack of co-ordination in the various factors of production or that the production was irrespective of the considerations of the principles of demand and supply. It will thus be of interest to look into the past history of the cultivator from this point of view.

At the time when communication facilities were meagre and the village was the social and economic unit in the country, farming was mainly self sufficing. The cultivator grew almost all crops in his holding and could obtain all his requirements of life by a system of barter. He would grow crops in such quantities as would satisfy his requirements. Whatever he could spare, he would carry to the nearest market and exchange it for other necessaries not available in the village. Thus there was a fair co-ordination between the forces of demand and supply. With the development of communications, the system of barter changed a little and the relative value of any commodity began to be affected by the amount of supply and demand. But the outlook of the cultivator changed only to the extent of the purchase of his necessaries and he still did not look to his concern as a business. The absence of business instinct in him has proved to be a great stumbling block in the raising of his status. His immobile nature has also proved to be equally detrimental. He little studied the demand outside, but confined himself only to such production as would bring him other necessaries of life in return. This naturally gave room to a class of people, who took advantage of the situation in studying the demand and supply of various places and adjusting the same to their benefit. This class of people is known as the "middlemen". In course of time, this class developed to a great extent and naturally a large share of the profits from agriculture went into their pockets. But this can be said to be the wages of the middlemen for the services they rendered in adjusting the demand and the supply thus bridging the gulf between the buyer and the seller. The only objectionable feature in the whole affair is the disproportionately large share of the profit which goes to the middlemen. Secondly as has been pointed out by the Royal Commission on Agriculture, (report of the Royal Commission on agriculture page 320) the cultivator is a small unit as compared with the distributors and consumers of his produce, who in their respective fields become every year more highly organised and strongly consolidated. Under these circumstances, it can be said that the cultivator carried on his business with little of organization. The marketing of the produce, a part of the organization, was done by the middlemen. Even today we can find middlemen and their agents going from door to door in the villages of the Central Provinces and Berar for purchasing cotton. The cultivator is tempted to sell the same at his doors since he gets money in cash. So also little attention was paid to co-ordinate the various factors of production to get the highest return.

With the development of quick transport and commercial relation with foreign countries mainly through the merchant class who are truly

middlemen the cultivator also became a little alert to the forces of demand. He also made changes in his cropping programme, wherein a money crop occupied a prominent place. The farming, which was till then diversified gradually changed to the specialized one.

But under the conditions described above, the cultivator never found himself in a precarious economic trouble under normal times. If at all anything has brought more difficulties on the cultivator, it is the boom prices of the agricultural commodities during and after the war. Herein, it can be said that the cultivator suffered only due to his lack of foresight to understand the nature of the demand and its likely direction in course of time. The cultivator failed to realise that the rise in the prices of agricultural produce in general and cotton in particular was due to an extra-ordinary emergency which was likely to be in force temporarily. The extra profit from land went in purchasing more land. The effect of this was that the amount of capital spent on land led the cultivator to invest proportionately increased amount on bullocks and labour. This increased investment was many times done by borrowed capital.

No sooner the boom period passed off, the prices fell down heavily. Consequently the amount spent on land and bullocks and other immovable stock became quite out of proportion to the total investment. Not only that the concern was running at a loss but it was not even possible for the cultivator to convert a part of his capital in the shape of land into working capital by selling it. He had an establishment on which he could not spend adequate working capital. Even if he had money to spend he could not get enough return in shape of profit.

It would thus appear that though the conditions around him changed completely, the farmer remained the same small unit, ignorant and immobile. Whatever changes appear in him were not adopted by him but more or less forced upon him by circumstantial pressure from outside.

In his present state, the cultivator is heavily merged in debts and that is a big charge on his farm-accounts. The extremely low prices of agricultural commodities makes his business either unprofitable or leaves a narrow margin of receipts over expenditure. Under these circumstances, one can imagine the plight under which the cultivator is treading on his path of life. The explanation of his present depraved condition can be found in the meagre resources of capital, which affects the supply of the seed, the manure and the cultivation of the soil.

After having said so much, a word about the peasant himself will not be out of place. It is still said that the cultivator is a conservative being and responds but slowly to the changed outlook. It must be remembered

however that under modern conditions, the causes affecting the economic condition of the farmers' business are widely diverse and any factor, acting in the far off land beyond the seas, has an effect on the same; but when we take into consideration his appalling ignorance of all such factors, the conservative nature of the son of the soil stands to justification. The real remedy lies in the spread of mass education, which will bring a change in his outlook. Serious efforts are already in progress in this direction, which are sure to prove fruitful.

But the dark past need not make us pessimistic about his future. In any scheme of economic planning on a national basis, the utilization of land for the production of raw materials will be one of the essential features. With the present drive towards mass education, the cultivator shall become conscious of the economic field in which he has to play his role. This will lead him to look to his agriculture as a commercial proposition. With this change of outlook, he shall not remain a misfit in the scheme of things, as he has been in the past. By the starting of new industries, there will be equitable distribution of the pressure of population on land and industry. Thus the future of the Indian peasant promises to be far brighter than perhaps we imagine, as agriculture shall still remain the main feature of our national life.*

A NOTE ON SINGHARA (WATER CHEST NUT) CULTIVATION IN THE JUBBULPORE DISTRICT

Dr. R. J. Kalamkar,
(*Dy. Director of Agriculture, Jubbulpore*)
AND
Mr. N. R. Ramaiya,
(*Extra Assistant Director of Agriculture, Jubbulpore.*)

Introduction.—Singhara is being grown from very ancient times and was a source of revenue even in the Moghal period. Its cultivation is done by a class of people called Dhimar or Kewat (watermen) and is practically a monopoly with them, like the growing of betel vines by the Baris or Pansaries.

Its cultivation is invariably confined to tanks which hold sufficient water about two to three feet deep in the hot weather. It is largely practised in tanks round about Jubbulpore and at various places in the Sihora tahsil. Majholi and Sihora are important markets for Singhara nuts.

* In this connection it is of interest to note the following :—

"But we must not expect that industrialisation is the key to the solution of India's economic problem." (Dr. Gyan Chand's Presidential Address to Economic Conference 1938).

Varieties.—The varieties of Singhara, commonly grown, are of two types, viz, (1) with spines and (2) spineless. Some of the varieties have black, green, red or white skin and differ in taste, size, shape, period of maturity, shedding habit etc. No systematic classification of the prevailing varieties has been done by the department.

The local names of some of the varieties grown with their characteristics are as below :

Lalka, *Gulra* and *Safeda* are best in yield and quality. They are comparatively spineless. *Lalka* has reddish skin and the fruit is of a bigger size. *Gulra* has blackish skin and rounded corners instead of the usual triangular shape of fruit, while *Safeda*, as the name indicates has white skin and is a bigger size fruit like *Lalka*. *Dudkua* and *Harira* are other spineless varieties commonly grown. *Harira* as the name indicates has greenish colour of the skin of the fruit. Dudkua variety can be identified by the irregular shape of the fruit and arrangement of the spine points.

Katila.—Has prominent development of spines on the fruits. It is an inferior variety with small size nuts.

Sowing of nursery.—After the harvest of the *Singhara* crop towards the end of December, a portion of the tank bed where there is about three feet of standing water is cleared of weeds and thoroughly puddled under feet and selected sound, ripe, green nuts are broadcasted at about 3" apart and pressed in the mud. Dry nuts do not germinate and hence, if there is any delay in broadcasting, the fruits are preserved in big earthen pots soaked in water for about 10 to 15 days.

About 2 to 2¼ maunds of seeds are broadcasted in an area of about 0.30 acres and the cuttings from this area suffice to plant an area of about one acre.

Germination and preliminary growth take place in about two months. In order that the young plants may not be washed away or float away by waves, a border of an aquatic creeper called *Nari Bhaji* is used. This creeper also serves as a boundary mark.

Method of transplanting.—The land for transplantation is selected in a tank where water stands about three feet deep till the break of the monsoon. The area is thoroughly cleaned of weeds and the mud at the bottom is puddled by trampling.

In about the middle of April the vines are plucked from the nursery. The sets or cuttings are cut such that the length of each cutting is one and half times the depth of water where transplanting is to be done.

Four to six cuttings are tied in a knot at the lower end in bundles, locally called *Goonj*. These bundles or *Goonjs*, form a unit for transplantation.

Each knot is placed in the mud about 9″ deep by holding it in the thumb and first finger of the foot and pressing it. Spacing given may vary from 3′ to 7′ each way. In deep water the spacing is generally narrower than that given in shallow water. After transplanting the sets are not disturbed for about 8 days during which time they strike roots. 8 to 10 days after transplanting, the bed of the tank is disturbed by a man who enters the tank. The mud so disturbed settles down on the buried portion of the cuttings and helps towards vigorous growth. The cuttings after germination give out branches from every node after about 15 days of planting. Fresh cuttings from these plants are removed to transplant more areas. Transplantation is thus done at varying intervals commencing from middle of April and continues till the monsoon sets in.

Growth period of the crop.—The branching and vegetative growth continues till the month of August when the water surface is all covered with foliage of the plants. Removing of weeds and killing of insects are important operations requiring constant attention for raising a successful crop of Singhara. In the tanks, water being deep, operations like weeding, collecting and killing of insects are performed in a *Donga* or a small boat made by hollowing a tree trunk.

The crop is in flowers by the middle of August and the formation of fruits sets in by the beginning of October and the fruits are ready for plucking by the end of third or fourth week of October. Harvesting of fruits continues till the end of December.

Effect of increase or decrease of water on the growth of the crop.—The increase or decrease of water in the tank to a certain limit is not reported to have any appreciable effect on the growth of the crop. When, however, the water level goes down below one foot the whole crop is likely to be damaged. Rise of water does not adversely affect its growth.

Insects pests and weeds.—The chief insect pests are the beetles which are of two kinds viz., red pumpkin beetle and black pumpkin beetle. They are locally known as *Kira Bondri* and *Lohia*. These damage the young shoots in the nursery as well as after transplantation. These pests are frequent during the break of rains while during continuous rains the crop is less liable to be attacked by them.

The insects are only picked by hand and killed. This requires continuous work and attention of the growers. No insecticides are used,

Use of effective insecticides will be of very great relief to the *Dhimars*. A demonstration of a suitable insecticide by the Department is worth undertaking.

The common weeds are the Algæ and water Hyacinth which are removed from time to time by the *Dhimars*.

Disposal of nuts; their use.—As observed already the nuts are ready for plucking by the end of October and harvesting of nuts continues till the end of December.

The nuts are sold green or after boiling. They are also dried in the sun for about 15 days. The upper coating is removed after drying and the dried nuts are stored and sold at 7 to 8 seers per rupee. The dried fruits are made into flour and eaten on fast days by Hindus by making sweets and other preparations according to taste. Commercially it is used for making *Abir* or *Gulal*, a red coloured powder, used on festival days like *Holi*.

Dried *Singharas* can be stored throughout the year. During rains they are stored in sand to save the damage from insects.

Economics of Singhara Cultivation.—No reliable figures regarding cost of cultivation, outturn and net profit are available. The information collected from various growers indicates that the cost of cultivation per acre may vary from Rs. 80/- to 100/- while the outturn per acre expected is about 20 to 25 maunds of dried nuts fetching about Rs. 100/- to 125/-, yielding a net profit of Rs. 20/- to 40/- per acre.

Rent of the tank per acre greatly varies. Round about Jubbulpore, in good established tanks, it may be as high as Rs. 50/- per acre. One man with one *Dongá* can ordinarily manage the raising of the crop in a plot of 20 yards x 200 yards *i. e.* approximately 0.80 acre.

Our thanks are due to Messrs S. L. Tiwari, (Farm Superintendent, Adhartal), Kartarsingh Cheema, (Agricultural Assistant, Jubbulpore) and P. R. Dube, (Agricultural Assistant, Sihora) for supplying information on the above from their respective tahsils.

PRICE CONTROL

Mr. N. M. JOGLEKAR, M.A., LL.B.

Why prices rise?—The declaration of a war introduces a host of elements which disturb the economic activities of a country in a number of ways. It ushers in an era of a novel economy—war economy, which is strikingly different from the peace economy to which one is accustomed. The essential features of the economic life of this era are the restrictions on the usual facilities for the transport of goods from one country to another, the stimulation of certain trades and business, the concentration

of the industrial plant of a country on the production of war material, large scale state purchases of foodstuffs and other war material, withholding of all the available stocks by the businessmen etc. All these factors combine together in raising the prices.

In India, the news of the break up of hostilities resulted in creating quite a stir in the market. The low level to which the prices were pinned down for over a decade registered a sudden revival, and every businessman put up the prices to a very high level. This immediate change may be attributed purely to the panicy psychology of a critical moment and to the desire to make the best of the opportunity offered i. e. profiteering.

As the various factors named earlier do not influence India's economy to the same extent to which they are influencing the European countries, which are actually engaged in the war, the indiscriminate rise in prices could not attain stability and a downward trend immediately followed. The action of the various Provincial Governments which declared profiteering to be penal also contributed to the same end. As time passed on, the artificially raised up prices declined to a level which was determined mainly by the new economic forces, which are active in a period of war economy. Though we may say that in India, the available resources and energies are not in any way appreciably engaged in the prosecution of the war as elsewhere, yet the very existence of the war creates rigidity and uncertainty in the business activity, to which may be attributed the continuance of the higher price level.

How far have the prices risen.—The extent to which the prices, particularly the retail prices rose as an immediate effect of the war cannot be very accurately estimated, as it was a very indiscriminate and uneven rise, mainly actuated by the profiteering motive. It therefore proved to be very short lived. Profiteering was most rampant in the sale of the imported goods particularly medicines and dyes.

We may compare the prices prevailing at the end of the year (in the light of the statistics provided by Dr. J. E. Gregory in a broadcast speech) *i. e.* December 1939 to the pre-war prices *i. e.*, 2nd September 1939. The general level of prices of commodities increased by 37%, of manufactured articles by 42%, food and tobacco by 25%, raw materials by 30% etc. Roughly, the prices rose by nearly ⅓ of what they were on September 2nd.

Effect of rising prices.—The rise in the price levels affects the various economic institutions of a country differently. It leaves a wider margin between the costs and the receipts and as a result the producers *i. e.* the manufacturers and the agriculturists are greatly benefited. In India,

they have hailed the present price revival as a welcome opportunity, and they pray for its continuance in order to lighten the great burden patiently borne by them through the long depression years. But the same cause affects the consumers, particularly the urban population, in the opposite manner. With the same expenditure, they cannot buy the same amount of goods which they used to buy before. Real incomes of the salaried and wage earning classes have fallen. Those having fixed nominal incomes are therefore by far the greatest sufferers. As wages and such other incomes are slow to move upwards, this class of the public cry for relief by means of the introduction of the state control of prices. Thus the present situation resolves itself into the form of a dilemma. Higher prices benefit the producers particularly the agriculturists who form the major portion of the population of the country, while the continuance of the same involves severe hardship to the urban population. Price control in one way is therefore highly detrimental, and in another way almost a necessity. Ordinarily, as long as the prices are within certain limits, the interests of the larger section of the population will have to receive precedence over that of the smaller, while some relief may be granted to the latter in other ways.

If however the prices are tossed up indiscriminately and vested interests begin to reap a windfall at the cost of others, leading to a disturbance of the peace and order in the country, or if it is found necessary for the successful prosecution of the war, the expedient of price control will have to be resorted to immediately. Thus the decision of such a nature must ultimately depend on the degree of the rise in prices. Again, while a certain rise in the price is allowed to be maintained for benefiting the producers, in actual practice, it is likely that a large portion of it may be pocketed by third parties; efforts will have therefore to be directed in securing to the producers their reasonable share, and disallowing any disproportionate gains to be made by the various intermediaries.

How to control the rising prices.—This is, "an enormously difficult technical job, calling for a combination of high economic wisdom and profound administrative skill." Attempts can be made on different lines. With regard to the agricultural goods, maximum prices may be fixed up by the Government for the wholesale transactions, or for the retail transactions, or for both. However, either of them cannot be very successfully settled. If the wholesale prices are fixed, the retailers will continue to exploit the consumer. If the retail prices alone are settled, wholesale prices may continue to remain at a still higher level, and thereby, they shall ultimately force a breakup of the retail price

structure. Thus it is necessary to initiate control at both the ends. This will assure a square deal to the producer and shall as well guard the interests of the consumer.

The task of price fixation bristles with great difficulties. As, well defined grades and standards are almost unknown in India in the retail markets, the task of fixing up prices for a variety of qualities becomes extremely difficult. Even if this is done with very minute attention there will be room for deception by the retailer, as uniform qualities are difficult to be got for sale, even ordinarily. Adulteration may become rampant, and it will have therefore to be strictly controlled.

The price schedules will have to remain elastic. Seasonal factors which determine the supply of goods will have to be paid due attention. Prices will have to be changed from time to time in accordance with them. When the rise in commodity prices is followed in due course of time by higher rents, interest and wages, the cost of production also increases. Allowance will have to be made for these increasing costs, and such changes will have to be made in the prices whenever necessary.

As regards the products of one place which are consumed in another, the prices at both the centres will have to be adjusted very carefully. A wide disparity between them (after making due allowance for the transport and other charges) will afford an opportunity for some to make a gain by transporting them from a cheaper to a costlier area. Thus the supply in the cheaper area will be dried up and the consumers will suffer, while third parties will gain. In such cases the movements of crops may also be restricted.

A plan of taking up only a few essential commodities for control may lead to excessive profiteering in the other uncontrolled commodities. A fairly large number of commodities will have therefore to be taken up for control.

Where a tendency of putting down the prices by the trader, while purchasing the produce from an agriculturist is observed, auction sales will be able to stimulate competition amongst the purchasers. This will enable the agriculturist to get a fair share of the higher price paid by the consumer to the trader.

The immediate policy.—To sum up, the present level of prices of agricultural produce cannot be considered to have reached a peak. They are in no way excessive, unfair or unreasonable. In fact, the present increase does not amount, even to a complete recovery to the pre-slump level. An All India plan of price control need not therefore be initiated at least at the present moment. However a well thought-out, and

expert machinery consisting of provincial units which will be able to control the retail prices and a central organization which will outline and regulate the whole-sale price structures, and will be able to co-ordinate the working of the provincial units will have to be kept ready. It may be set in motion as soon as the need for it arises. In the meantime closest attention be paid in recording and watching the trend of prices.

Simultaneously, action in other directions should also be initiated. Cost price grain shops may be started to afford relief to the consumers who might otherwise be subjected to profiteering by the retailers. Such shops will help keeping down the prices in the adjoining retail markets. Sales in these shops must be carefully carried on so as to avoid any disuse to be made of this facility. Large industrial establishments may also keep such shops for the benefit of their employees. The salaried and wage earning classes should receive sympathetic attention in giving to them a dearness allowance, if possible.

THE HARDA AGRICULTURAL AND INDUSTRIAL EXHIBITION

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Of late there has been a great awakening in India in all branches of life and steps are being taken towards the commercial and industrial advancement of the country. No less important has been the improvement achieved in the agricultural industry and efforts are now being made to make themselves known to the public at large through exhibitions and shows like the All India Agricultural and Industrial exhibitions, All India Cattle shows etc. Through such exhibitions and shows, persons all over the country come in contact with each other, and exchange of thoughts, ideas, culture etc. is brought about and they come to know about the activities in different parts of the country. But such large scale exhibitions are attended by only a part of the population which can afford to go long distances and witness the show. So, in addition to such all India shows held on a large scale, it is essential that small but instructive shows should be held at different places in rural areas to educate the poor villagers and to acquaint them with the progress and advancement which are being achieved in different aspects of life. It was with this end in view that the Agricultural and Industrial exhibition was held in the Guljar Bhawan at Harda.

It will not be out of place here to give a short description of the life history of Guljar Singh, in whose memory has been erected the building called after his name as Guljar Bhawan. It was in the premises of Guljar Bhawan that this Agricultural and Industrial exhibition was held

Thakur Guljar Singh was born in the year 1901. From his early youth he had begun to take part in the struggle for the freedom of India and had done great sacrifices. He was a congressman. In the civil disobedience and non-co-operation movement of 1921, he had taken a leading part and had also been jailed. He took keen interest in the fight and was busy in the activity till 1926. Then he devoted himself towards education and graduated in the year 1930. Again in 1931, the civil disobedience movement started and Thakur Guljar Singh was seen leading the men of Harda in the national fight. Since then he always took active part in the politics of the tahsil and was always some prominent office-bearer of different committees and organisations. He died an untimely and early death on the 16th day of June 1937. To commemorate his memory, and to pay tribute to his sacrifices, Guljar Bhawan was built and in its premises the exhibition was held.

The exhibition was declared open by the Ruling Chief of Makrai State on the afternoon of 4th February 1940. The Maharaja went round the different stalls and expressed great satisfaction over it. Though the exhibition, being local, was a smaller one, it was quite perfect and educative and carried out the purpose for which it was meant. It mainly consisted of the agricultural section, the industrial section comprising of different handicrafts, cottage and village industries coming from different places, the arts-exhibition-gallery and a few shops. The Department of Agriculture of this Province has always tried its best to make people know about the different improvements and achievements which are being attained in the science of agriculture and it has sent its exhibits to different exhibitions whenever they were held and as usual it did not lose the present chance offered to it.

Two big stalls were given to the agricultural section for exhibiting the different agricultural products and farm implements, while a third one was provided outside the compound for cattle. The agricultural section comprised of many sub-sections; a short description of which is given below. Most of the exhibits were those taken to Tripuri exhibition and hence they have been very briefly described, since a detailed description of them has already appeared in a previous issue of this magazine.

The main agricultural section consisted of different varieties of improved crop seeds produced by the department comprising of wheat, gram, juar, tur, linseed, cotton, bajra etc. Varieties of these different seeds were also called for from the local cultivators and selected ones from among them were kept for exhibition. There was a very large number of varietal exhibits. Very good samples of chillies, potatoes, tomatoes,

cucumbers, guavas, santras, mosambis etc. were also exhibited, and many good ones out of these were from the cultivators. This showed that with proper care the profession of agriculture can be made profitable.

To show the proper method of preparing farm-yard manure, a small model of covered manure pit was prepared nearby. Different charts were hung on the walls giving information about agricultural facts and figures.

Exhibits from the Agricultural Chemists section comprised of (i) specially prepared graphical chart showing the mechanical composition of important soils found in the Harda Tahsil, (ii) different manures and fertilizers, (iii) feeds and feeding stuffs, (iv) many charts illustrating the effect of manuring and rotation of crops, fixation of atmospheric nitrogen by various leguminonus crops from the soil per acre, ill balanced and well balanced diet on the economic basis, samples of gur prepared by different methods and showing the superiority of the application of improved method, sample of mineral brick lick etc.

The most remarkable feature of this section was the very simple and quick method of testing the adulteration of vegetable ghee. Most of the cultivators and many malguzars and traders in ghee were much interested in the method. Second thing was the mineral brick lick prepared by the Agricultural Chemist, which is intended to cure the mineral deficiency in the cattle and keep them healthy.

The Mycological Section had sent exhibits consisting of specimen of the diseases of cotton, juar, wheat, oranges, tomatoes, sugarcane etc. and cards containing the causes and preventive methods and curative measures.

Exhibits from the Entomological Section comprised of specimen of different pests and insects of crops grown in the Province and charts giving life histories and control measures. Machines and sprayers used for killing insects and their working was also demonstrated.

Oil Seed Specialist's Section had sent samples of linseed fibre, cottonised linseed fibre and different articles like durries, sadis and agricultural articles such as ropes all of which were made of linseed fibre. Linseed stalks which at present were mostly thrown away, offer, it was shown, great opportunities for the development of cottage industries.

Among the exhibits from the second Economic Botanist were samples of improved varieties of wheat, gram, tur, urid, castor, leguminous fodder and fodder grasses. The various types of fodder grasses and their mixture form a very nice and nutritious feed.

The local Veterinary Department had also exhibited the various instruments and had hung many instructive charts.

The exhibits from different sections were demonstrated and explicitly explained to the visitors by the different persons in charge of these sections, while through popular lectures, it was shown to the people as to what the Department stood for and what it was doing for them. It was observed that in general, the cultivators from the interior were almost ignorant of the activities of the Department and did not know how to take advantage of them. This, of course, is bound to happen till illiteracy is removed from the rural areas and enlightenment of the masses is brought about.

In the implements shed, local and imported implements were kept, their working and advantage of each over similar others was explained.

In the cattle-shed best specimen of animals selected from local cultivators were kept.

A selection of good exhibits coming from cultivators and consisting of different seeds, fruits, cattle etc. was made by the exhibition committee and prizes were given to the best ones. Such an action gives an impetus to the cultivators to produce better stuffs and in a way helps in the uplift of rural India.

Apart from Agricultural sections, another very interesting feature was the demonstration of fruit preservation, fruit canning and preparation of fruit products such as jellies, jams, squashes, syrups etc. and also chocolates sharbats etc. Such industries are suitable types to be introduced profitably in the cities and villages as well. The person in charge demonstrated practically the methods of preparing various food products from different kinds of fruits like guavas, santras, tomatoes etc. He also showed the methods of their preservation for long time on the economic and industrial basis as well as the methods by which these substances could be prepared at home in villages without any requirement of elaborate and costly apparatus. Such an industry is a model one and should be fostered for it provides employment both to the urban and rural population—to the latter by producing fruits and fruit-trees and supplying raw material and to the farmers from industries converting the raw products into finished ones. Lectures were given by the officer-in-charge of this section to men and women separately explaining the methods of preparing fruit products with practical demonstration and showing the advantages and nutritional and medical values of these stuffs.

Other industries demonstrated in the exhibition and offering a good scope of work for the unemployed were the preparation of paper flowers, decorative and ornamental things from pithwood, colouring and making colour designs on paper by very simple methods.

The arts exhibition gallery contained a vast number of artistic things including photo sketches, models, idols, paintings and needle and embroidery work. These things were beautiful and one could not but appreciate them. Very remarkable thing in this section was the small ideal village and ideal town prepared out of earthwork and card-board. The small model village showed the different fields with their situation in the village area, garden, common temples, common grazing lands, houses etc., while the town was prepared out of card-board buildings and roads decorated with electric lights.

The Apical department of the All India Village Industries Association had also demonstrated the industry of bee-keeping by means of the Wardha type of bee-hives.

The exhibition lasted for one week and was declared closed on the evening of Sunday the 11th February by the Maharaja of Makrai State who gave a donation of hundred and one rupees to the Village Uplift Committee of Harda. A very good amount of money was spent in awarding various prizes to selected articles and exhibits. The whole week was made more busy and interesting on account of different entertaining programmes arranged, while the arrangement was systematically and successfully done by the local scout organisation.

In a small place like Harda, this exhibition was more than a success. Effective propaganda was made in the interior villages, and a large number of villagers daily flocked together to see the exhibition. As calculated from the daily sale of tickets, not less than two to two and a half thousand visitors were coming daily. It was really instructive and educative and it can serve an ideal for other tahsils of the Province. If such exhibitions were held in the different parts of the Province, and if demonstrations of modern agricultural improvements were made practically on a still larger scale, they will serve to bring about an enlightenment of the rural population and inculcate the cultivators by bringing them in contact with what is being done in the Province and other parts of the country.

Extracts

THE COMPOSITION OF FRUITS IN GENERAL AND CEYLON FRUITS IN PARTICULAR

Fruits contain high percentages of water, the latter varying from 65 to 90 per cent. Of the local fruits examined, bael is a striking exception, its moisture content being only 44 per cent. Other fruits with relatively low moisture contents are the kolikuttu plantain and bullock's heart (which contain about two-thirds their weight of water), and jak (pulp).

The edible portions of fruits constitute, in the majority of cases, from 40 to 85 per cent. of their weight, the exceptions being young coconut (kernel) with only 7 per cent. and jak (pulp) with 31 per cent of edible flesh on the one hand, and tomato with 97 per cent, and guava with 100 per cent edible matter on the other. Most varieties of guava have, however, a high proportion of seeds which are in reality waste material.

The other constituents of fruits are: carbohydrates comprising sugars, starches (in small amounts only), gums, pectins and fibre, organic acids which with the sugars determine fruit flavour, mineral matter, proteins and fats in small quantities (with certain noteworthy exceptions), essential oils and esters, which give them their aroma, vitamins and colouring matter. The characteristic vitamin of fruits is vitamin C, but certain fruits, e. g. mango, papaw, plantains, avocado pear, contain vitamin A or carotene in relatively fair quantities. Some local fruits such as the papaw and pineapple contain proteolytic enzymes, papain being obtained from the former and bromelin from the latter.

Carbohydrates.—The carbohydrate figures, which as already explained are obtained by difference, would vary to an appreciable degree with the moisture contents of the fruits. In the case of the fruit samples examined, the amount of carbohydrate varies from 3.2 per cent. in young-cocount kernel to 52.0 per cent. in bael fruit. The plantain, jak, custard apple, sapodilla, and bullock's heart are also relatively rich in carbohydrates while the avocado pear, young-coconut kernel, tomato, and lime are poor in these food constituents. Sugars constitute over 50 per cent of the total carbohydrates in the mango (particularly the parrot mango which is noted for its sweetness), ripe plantain, jak, sapodilla, papaw, and mangosteen. The guava has been reported (3) by workers in Bombay to be rich in sugars, but the sample examined here, which was of the local variety, was found to be otherwise. Fruits which have only traces of sugar are the tomato, avocado pear and lime. In the bael fruit and woodapple less than 20 per cent. of the carbohydrates consists of

sugars. Starches and mucilages in the former and pectins and other such compounds in the latter probably constitute the main bulk of their carbohydrates. In most fruits the cane sugar content is higher than that of the reducing sugars. The reverse holds in the case of the plantain. The latter finding is confirmed by the work of Widdowson and McCance (4) with bananas, but not by that of Poland, etc. (5) The discrepancy in results is probably due to differences in variety of fruit and possibly methods of analysis.

Ether Extract—Oil and Fat.—The avocado pear and the young coconut kernel are outstanding in respect of their fat contents. The local sample of the former contained 17.5 per cent of oil or over 70 per cent. of the dry matter of the fruit pulp. The latter contained 10.8 per cent. of oil or over 50 per cent. of the dry matter of the kernel. Work in California (6) and India (7) has confirmed the results obtained locally with the avocado. The name " butter fruit " by which this fruit is also known is well-deserved. The other local fruits with the exception of the sapodilla, have very low fat contents.

Fibre.—The fibre figures need but little comment. The woodapple and guava (the latter owing to its seed) have highest fibre contents. The young-coconut kernel has more fibre than might be expected.

Protein.—The protein contents of all local fruits are low. Woodapple has approximately 3 per cent. protein, while bullock's heart custard apple, young-coconut kernel, jak, and bael have about 2 per cent. of this constituent. Mangoes, guavas, and plantains have only about one per cent. of protein.

Calorific value.—Bael fruit, avocado pear and kolikuttu plantain have highest calorific values, with bullock's heart and jak pulp closely following. These fruits form about a third to a half of the calorific value of energy foods such as cereals.

Titratable acidity.—This varies from 8 c. c. of N/10 acid per 100 g. for the kolikuttu plantain to 954 c. c. for lime. The woodapple is strongly acid with an acidity value of 537 c. c. while other fruits with high acid contents are the tomato, tree tomato, orange, grapefruit, pineapple, and soursop. The sapodilla, papaw, and avocado pear contain but little acid. The sour plantain has an acid value similar to that of the parrot mango.

Mineral matter.—The percentage of mineral matter varies from 0.16 per cent. in the mangosteen to 1.72 per cent. in the bael fruit. The woodapple, bullock's heart, and avocado pear also have high ash contents. Of all the constituents of fruits, none is likely to vary so much in different samples of the same fruit as the individual mineral constituents

Calcium.—The calcium contents vary from 4.3 mgm. per 100 g. for sapodilla to 80.4 mgm. per 100 g. for woodapple. The interesting point is that while woodapple has a high titratable acid value, it has also a high calcium content. The latter fact has been confirmed by Indian workers (7). But the calcium contents of local fruits are lower than those of corresponding samples analysed in India. Other fruits which contain relatively high amounts of calcium are bael, bullock's heart and orange. Besides the sapodilla, fruits low in calcium are mangosteen, plantain, avocado pear, tree tomato and pineapple. The sample of sapodilla examined was grown on a sandy soil, deficient in lime. Hence perhaps, its low calcium content.

Phosphorus.—The phosphorus contents of the fruit samples examined range from 6.3 to 55.6 mgm. per 100 g. The following fruits show low values:—papaw, mangosteen, tomato, parrot mango, guava. Woodapple is richest in this constituent also, others showing high values being bael, young-coconut kernel and avocado. Compared with the Indian figures (7) the phosphorus contents of local fruits are invariably poorer.

General discussions and summary.—The results of analyses of 22 samples comprising 20 species of local fruit, generally confirm the findings of workers in India (7) and the Philippine Islands (8) in regard to the composition of the fruits examined. Differences are, however, apparent particularly in regard to the mineral contents. The Indian figures for calcium and phosphorus are invariably higher than the corresponding local figures. Climatic and soil differences would account for this fact.

Local fruits, like most fruits, have (1) high moisture contents a notable exception being the bael fruit, (2) low percentages of portein, (3) traces of fat, except in the avocado pear and young-coconut kernel, which are both rich in this constituent, (4) relatively high amounts of carbohydrates, the greater proportion of which is, in many cases, cane and reducing sugar, (5) varying quantities of organic acids—lime and woodapple being the most acid of those examined, (6) mineral constituents in very variable proportions, (7) vitamins, mainly vitamin C, though a few are relatively well-supplied with vitamin A or its precursor carotene, (8) essential oils and esters which give the aroma to the fruits.

No details are given in this paper of the vitamin contents of local fruits as these have been furnished in a previous publication (1). The papaw and the pineapple are characteristic in that they contain proteolytic or protein-hydrolysing enzymes of commercial value. Thus the papaw supplies papain and the pineapple bromelin.

Of the fruits examined bael, avocado pear, plantains (the kolokuttu variety) and young-coconut kernel have highest calorific values. the high oil content of the avocado and young-coconut kernel contributing to this result. Plantains, jak, sapodilla and mangoes are rich in sugars. Woodapple is richest in both calcium and phosphorus, bullock's heart and fruits containing largest amounts of fruit acids are lime, woodapple and tree tomato.—(*Tropical Agriculturist Vol. XCIII No. 6, December 1939*).

Yams Tubers etc. are all starchy foods. They differ but little in analytical composition, but artichoke is relatively poorer in fat than the other samples examined. Yams are generally poor in calcium; some of them viz, the colocasias (desaiala and dehiala S.) are rich in phosphorus. The iron contents of two samples of yams are low.

Oil seeds etc.—The mineral analyses of gingely indicate that it is very good source of calcium, phosphorus and iron. This is food crop the cultivation of which should be encouraged in Ceylon, for the reason that in addition to being well supplied with the essential mineral constituents, it is rich in protein and fat (1). A minor food product of some interest, from the nutritive standpoint, is wild breadfruit (wal del S) seed. Unlike jak, this seed is essentially an oilseed. It contains 34 per cent, of oil and 13 per cent of protein and is fairly well supplied with phosphorus, but is relatively poor in calcium.

Young-coconut water.—With a view to making the investigation on the nutritive values of local foods more complete, samples of king coconut (tambili S.) and young-coconut (Kurumba S.) water were examined and compared with that of a mature coconut. Carbohydrates are the main constituents of the water of young coconut. Reducing sugars (3.95 and 3.46 per cent. respectively) amount, on the average, to over 85 per cent of the total carbohydrates. Cane sugar is present only in small quantities (0.31 and 0.56 per cent.) In the water of mature coconut, the total carbohydrate content is lower (2.5 per cent. in one sample), but the sucrose content is relatively much higher (1.9 per cent). Apparently, as the coconut matures, reducing sugars are converted into cane sugar.—(*Tropical Agriculturist Vol. XCIII No 6, December 1939.*)

DEVELOPMENT OF MODERN COMPOSTING METHODS

The deliberate use of rotted organic wastes—vegetable and animal—for the purpose of growing larger quantities of better crops seems to be as old as the art of agriculture itself. It is conceivable that primitive man may have simultaneously (1) noticed the superiority of natural vegetation growing in virgin forest land rich in organic matter, and (2) discovered the possibility of artificial cultivation of some of the plant species suitable for his food.

At any rate, the importance of farmyard manure to crop growth has been stressed in ancient Indian and European literature (Russell and Richards 1917). King (1926) has described in detail how the Chinese peasants of old took elaborate care to collect all available wastes and convert them systematically into well-rotted composts. It is noteworthy that in every part of the world this system of returning its own waste material to land has maintained soil fertility in spite of continuous cropping through the ages. The crowded population of China is still being maintained on the produce of its soil after its agricultural use for over forty centuries. This is perhaps the most convincing proof of the perfect balance of ancient systems of agriculture with their environment. It is very striking, indeed, that modern composting technique has very little to add to the basic principles underlying the Chinese method of making manure from agricultural wastes.

Liebig published in 1840 his essay "Chemistry in its application to Agriculture and Physiology". This marked the beginning of a period when scientific investigations and commercial enterprise concentrated on the stimulation of crop production by means of factory-made chemical manure. Subsequent work at Rothamsted and elsewhere established the manufacture of artificial fertilizers on a sound footing. Factories engaged during the war in the fixation of atmospheric nitrogen needed new markets afterwards. This further intensified the use of chemical manures. The use of buky farm manures fell into the background. It was even asserted that this practice was not an essential feature of agriculture. A school of scientific workers, however, soon arose who maintained that a certain proportion of humus is essential to preserve the crumb structure in soils and that such a structure in turn was essential for efficient plant growth (Russell, 1934; Symposium on Soil Organic Matter, 1927).

Another group of scientists (Howard, 1937, 2) believed that the artificial stimulation of soil activities for commercial cropping was sure to upset the natural balance of soil factors and in the long run might lead to evils not yet fully realized. They maintain, therefore, that in any agricultural system adequate provision is absolutely necessary for returning all the waste products of agriculture back to the land. Howard (1937, 1) even maintains that in specialized systems such as the planting industries it may be necessary to make provision for the supply of humus to the soil by manufacturing it at extra cost from other sources to enable the soil to meet the abnormal strain resulting from highly intensive cultural practices.

Also, the large majority of the cultivators in the world still believe that the produce obtained by the use of chemical manures is not always equal in quality to that obtained by the use of ordinary farm manure.

Recent discoveries of workers on animal nutrition have apparently confirmed this belief by their findings (McCarrision, 1926, 1937; Viswanath and Suryanarayana, 1927: Ramiah, 1933). It has also been claimed (Howard, 1937, 1) that the use of humic manures from vegetable and animal wastes imparts disease resistance both to crops and the animals that feed on them. Recently a fresh impetus was received by the investigations into the nature of soil humus and the decomposition of organic wastes to humus (Russell and Richards, 1917; Waksman et al., 1929; Du Toit and Page, 1930, 1932; Waksman and Iyer, 1932, 1933; and others). This was accompanied by zealous attempts of other workers to discover how to make larger quantities of humic manures and how to increase the speed of the decomposition (Carbery and Finlow, 1928; Rao and Subrahmanyan, 1932, 1935; Anstead, 1932; Gadgil and Hegdekatti, 1937). These workers aimed at ensuring a copious supply of cheap and properly made humic manure.

Richards and Hutchinson (1921) artificially converted straw to humus by the help of ammonium sulphate. This lead to the development of the patented " Adco " process.

Fowler (1930) and Howard concentrated their efforts on the utilization of all available organic residues for making composts of the Chinese type. Fowler stressed that it is necessary to build up an intensively active biological starter of the proper type to ensure a good start and maintain the speed thus secured throughout the course of decomposition. His system of making " activated composts " is founded on this principle and is applicable equally to both farm residues and town wastes.

Howard aimed chiefly at making all types of residues into composts and thus increasing the supply of cheap humus. He saw in this a means to compensate for the existing shortage of cattle dung for manure-making in India where cattle dung is badly needed for fuel purposes in the absence of a satisfactory substitute. His work in this direction culminated in the development of Howard and Wad's Indore Process (1931, 1935).

This process aims at utilizing the harder residues by making them less refractory to the influence of the fermenting micro-organisms by the physical cracking of tissues or by exposing them to the corrosive environment of actively decaying material of a better composition. It lays special stress on starting the heap with a physical structure capable of maintaining adequate aeration without undue loss of moisture all through the period of decay notwithstanding its compaction due to the

shrinkage of the rotting mass. It is maintained that a properly made heap will very soon develop within it all the required intensity of microbiological activity by itself. All the temperature ranges and sequences of the types of micro-organism necessary for composting will automatically appear. The process is aerobic, clean and sanitary as well as cheap and simple. The final product always maintains the proper standard of quality.

The process, therefore, spread rapidly all over the world and is applicable to a large variety of cultural systems and environments. It can convert all types of wastes quickly into well-rotted composts. This is typically illistrated by its application (1) to the disposal of habitation wastes (Jackson and Wad, 1934; Howard, 1935, 1937, 1938), (2) the composting of cane trash (Tambe and Wad, 1935; Dymond, 1923, 1938) and of sisal wastes, the wastes of tea, coffee, rubber and coconut and oil palms (Bagot, 1936; Howard 1938) and its modifications for making composts with rain water (Timson, 1939) and by the intermittent supply of water from canals (Jackson, Wad, and Panse, 1934).

Fowler (1930) seems to have considered partially anaerobic conditions during the later stages of decomposing heaps as having some beneficial effect.

The author of this note has observed that under the hot arid climate of the Rajputana desert the compost made with three turns had an inferior chemical composition than that produced by one turn only. It appeared that due to the different degrees in the ease of fermentation of the various components of the heap the more easily decaying portions under the stimulus of local climate reached the stage of complete oxidation and consequent losses by the time the more refractory parts were sufficiently crumbled down. It is possible that losses of this nature may be kept down by lessening the number of turns or altering their intervals to regulate the ventilation to the desired degree.

While investigating the possibilities of the hot fermentation process Rajgopal et al. (1936) have concluded that in compost heaps a better conservation of carbon and nitrogen is possible when anærobic conditions follow after a vigorous ærobic start with rise of temperature. The mechanism by which this is brought about is yet to be fully investigated.

Howard (1937) has recently evolved what he calls "Sheet Composting". This seems to suit wherever labour is scarce or costly. Residues of field crops are composted in situ in the field without collecting and removing them. The conditions in sheet composting are perhaps semi-aerobic. The following description by Howard will illustrate an application of this principle:—

This development was worked out during the last two years on the potato areas of South Lincolnshire which have been to suffer from shortage of humus. After the pea-crop grown for canning has been harvested, the land is immediately drilled with beans. The sown area is then covered with a layer of crushed straw from the shelling machines followed by a thin layer of farmyard manure. The Indore process then sets in on the surface of the soil. The beans grown through the fermenting mass and at the end of September are ploughed in with the layer of finished compost. Decay is rapid and by the time the fields are planted in potatoes the following spring the resulting humus has been incorporated in the soil and is ready for nitrification. This modification is known as sheet composting—the making of humus in a thin layer all over the surface. Catch crops of beans or mustard or a crop of weeds can also be manured with humus. The turf of old pastures or old leys can be converted into humus in a similar fashion. The Indore process has in this way been applied with success to no less than three important practical problems, green manuring, the effective utilization of weeds and stubble and the better utilization of the old turf of grass land.

Similar attempts at simplification are being made by applying waste organic matter direct to the soil with inorganic reinforcements (Eden, 1935, 1936). The present system of burying tea prunings and loppings of shade tree along with the chemical manures may also be considered a similar operation.

It appears to the author that perhaps the most economic and convenient method of returning waste material to land will be a preliminary aerobic decomposition to a suitable stage followed by direct application to the field, a few weeks before sowing time, before preparatory cultivation begins. There seems to be some scope for such a method as it involves the least deviation from current routine as well as the minimum of labour and care. (*Agri. and Livestock in India Sept. 1939*).

BORE-HOLE LATRINES AND VILLAGE SANITATION

Bore hole latrines consist of a circular hole 14 to 18 inches in diameter and 15 to 20 feet deep. They are most succesful if the hole goes atleast 3 feet below the surface of ground water. A squatting slab or plate of reinforced concrete 30 inches by 36 inches by 2½ inches with a slope to the hole 10 inches by 6 inches at the centre, is placed over the hole. The enclosure may be built of mud walls, old gunny bags, or corrugated iron sheets, cotton stalks etc. to afford privacy and protection from sun and rain. The holes are bored by means of special earth-augers

in the earth which is moderately hard and compact. The site selected for such a latrine should be preferably in the backyard of the house and should be 50 feet away from any well or tank and not subject to flooding. Such augers can be bought from the Allahabad Agricultural Institute or Sangli Mission (Deccan), at a cost of about Rs. 35. In the earth of average hardness, two men can make a hole 15 to 20 feet deep in 8 hours. Where surface soil is soft, an empty barrel of 18 inches or cement cylinder should be placed to support the walls of the holes.

A squatting slab is prepared by mixing cement and sand in the proportion 1 to 3 or 4 in wooden frame of 2½ sq. ft. A wire frame 24″ by 24″ with atleast 6 wires 1/10 of an inch thick inside the frame at a distance of 4″ apart, should be kept into the above mentioned mixture to strengthen the slab. When a good number of bore hole latrines are in demand, the cost of manufacturing cement concret slabs comes to Re. 1-8-0 to Rs. 2-0-0. The cost of making the hole should not exceed annas 12. The enclosure materials cost nothing practically in villages. So if by propaganda a good number of this type of latrines are introduced, it should not cost more than Rs. 2-8-0.

When they fill up to 2½ ft. from the ground level they should be filled up with dry earth and the squatting slab maybe removed and placed over fresh bored latrine. This latrine can be used by a family of 5 or 6 members, for an year. After allowing the used hole to ripen for atleast six months it may be bored out again for use as a latrine and the earth removed can be used as a valuable manure.

If properly made and used, there is no bad smell from it and flies do not get into it.—(*Rural India--Jan. 1940*).

INDIA'S RISING STANDARD OF LIVING !

No increase in pressure on land

More employed in Industry and Agriculture

A study of three decades.—The assertion that pressure on land has been increasing in recent years is not borne out by facts, says Dr. B. G. Ghate, in a study on "Changes in the occupational distribution of the population" issued by the office of the Economic Adviser to the Government of India.

The enquiry, which is based on the occupation statistics contained in the Indian Census from 1901 to 1931, has been made in view of the uneasiness at times shown at what is considered to be the slow growth of the industrial population in India.

If the total number of persons following agriculture as a primary and principal occupation be taken together the number of persons occupied in pasture and agriculture shows a considerable increase over the preceding years. The increase in the number of persons following agriculture as a subsidiary occupation is due partly to changes in classification, and partly to the development of small-scale industries in the countryside.

The great importance of such industries as an instrument for raising the standard of living has now been generally recognised; and the reports of the Registrars of Co-operative Societies and the Directors of Industries in the various Provinces show that the concerted efforts on behalf of the provincial Governments in fostering these industries are being met with an increasing measure of success.

The factors which are now favourable to the development of such industries are:—

(1) increasing population;

(2) increased facilities for technical advice and the financial support from the provincial Governments;

(3) better facilities for marketing, through co-operative and other marketing organisations;

(4) changes in fashion by which the produce of such industries is becoming popular especially in the urban middle classes.

It is probable that these factors will continue to operate for a long time to come and, therefore, that the development of such industries will not only help to raise the standard of living but also provide an increased scope for subsidiary occupations to a large number of people living in the countryside.

The number of persons occupied in the cultivation of special crops shows a progressive increase during the past 30 years. The special crops are mainly tea, coffee, fruit and vegetables, tea alone accounting for about 25 per cent of the total number occupied. This increase shows that the people are now consuming larger quantities of tea, coffee, fruits, vegetables etc.

It is significant that the increase in special crops which generally fetch a higher price than the ordinary crops like rice, pulses, etc., and the increase in subsidiary industries are important factors which tend to raise the standard of living of the cultivator and tend to lower the pressure on the soil.

There has been an enormous increase in the number of subsidiary occupations connected with industry and an increasing number of

agriculturists are now devoting their time to such occupations with a view to supplementing their income from the land during slack season.

Figures collected by Dr. Ghate show that industrial employment has been increasing at a rapid rate during the past 20 years. Although these figures relate only to organized labour they may be taken as indicative of general employment both in organised as well as unorganised industries. Moreover the emergence of numerous small industries in urban and rural areas during recent years clearly proves that there has been a considerable progress in industrial activity, and there is every reason to believe that the forces now favourable to industrial development will gather greater strength during the next few years.

In most of the discussions on occupational changes the fact that industrial occupations have been increasing progressively has been generally overlooked and attention has been concentrated only on the large number of people occupied in agriculture. It has been argued that the large increase in population during recent years and the absence of a correspondingly large increase in industrial occupation as shown by the Census Figures for 1931 must inevitably result in reducing the standard of living and that the larger the growth of population the greater, in the absence of industrial development, must be the poverty of the people.

A Popular Fallacy.—Such impressions are based on a confused notion that the only alternative to agricultural over-crowding lies in the transfer of a large number of people from the agricultural into the industrial occupation.

But it is not yet properly understood that with future development of the country there will follow an increased demand for personal and professional services which will create new occupations and fill the gap between the growth of population and industrial employment without increasing the pressure on the soil.

It is significant that India is not the only country which, with a well-developed agriculture, is faced with the problem of a rapidly increasing population. In the United States of America the population has been growing at a more rapid rate.

Although there is every reason to believe that industrial occupations will continue to increase for the next few years, it is highly unlikely that even under the most favourable conditions possible, the proportion of industrial workers per 1,000 of the working population will be much higher than it is today. Even assuming that Indian industries have not yet reached the maximum limit of expansion there is no reason to believe that the forces which tend to lower the proportion of industrial workers

in other countries will not, after a certain stage of development, begin to operate in India.

This does not justify alarm and pessimism because there has been considerable increase in occupations connected with the distributional services and also with personal and professional services. Changes in occupations connected with these industries show that ths tendency now operating in the United States of America and most of the highly developed industrial countries of the world have to a higher extent begun to operate in India.

Between 1921 and 1931, the number of people employed in Industry increased by 10 per cent., in Law by 236 per cent., in Medicine by 25 per cent., and in Instruction by 49 per cent. The increase in trade in articles of luxury, chemical products, bricks, pottery, tiles, etc., cafes, hotels and restaurants and trades in miscellaneous articles show the changing requirements of the people arising from changes in social and economic habits.

It would, therefore, appear that much of the dis-satisfaction caused by the apparent lack of a large increase in industrial employment shown in the Census statistics has been due to an undue emphasis on the possibilities of industrial developments as the only solution of the problems of unemployment or under employment in agriculture.

The concentration of attention on the industrial aspect of the problem, to the exclusion of all others, is also responsible for the general impression that the growth of population and the excessive dependence on agriculture are gradually lowering the standard of living. With the further economic development of the country, however, there will be an increased scope for almost all the occupations and new channels connected especially with distributional and other services will arise and will continue to absorb a larger proportion of the growing population.

There has been a progressive decline in the number of females occupied and this is particularly well-marked in the 1931 figures.

This decline has given the impression that the total number of persons occupied has also been declining although the number of males occupied show in every census and in every occupation a considerable increase. This decline in the number of females is largely due to changes in classification which also affect the increase in the number of males occupied.

If the classifying methods of "workers" and "dependents" had remained the same in 1931 as in 1911 and 1921, it is certain that the total number of persons in each occupation would have shown a much greater increase than it actually does in 1931.

Moreover, it is probable that in respect of certain occupations namely exploitations of minerals, preparation and supply of material substances, trade in foodstuffs and building materials etc., the 1931 figures are considerable underestimates. The importance of these changes should, therefore, be borne in mind in making a comparative study of the occupational changes and due allowance should be made for them. (*Indian Information of 1st Feb. 1940 Vol. 6*).

CHANGES IN THE NOMENCLATURE OF IMPROVED VARIETIES OF CROPS ETC. BRED AT THE IMPERIAL AGRICULTURAL RESEARCH INSTITUTE

A list of the old and the new names of the varieties of crops under distribution is given below: —

Crop.	Old name.		New name.	
Wheat	Pusa	4	I. P.	4
"	"	12	I. P.	12
"	"	52	I. P.	52
"	"	80-5	I. P.	80-5
"	"	111	I. P.	111
"	"	114	I. P.	114
"	"	120	I. P.	120
"	"	125	I. P.	125
"	"	165	I. P.	165
Barely	" Type	13	I. P.	13
"	" "	21	I. P.	21
Oats	" B. S.	1	I. P.	1
"	" B. S.	2	I. P.	2
"	" Hybrid	C	I. P. Hyb.	1
"	" "	G	I. P. "	2
"	" "	J	I. P. "	3
Paddy	" Type	9	I. P.	9
"	" "	18	I. P.	18
"	" "	24	I. P.	24
"	" "	31	I. P.	31
"	" "	52	I. P.	52
"	" "	124	I. P.	124
"	" "	129	I. P.	129
"	" "	144	I. P.	144
Rahar	" "	15	I. P.	15
"	" "	24	I. P.	24
"	" "	51	I. P.	51
"	" "	64	I. P.	64
"	" "	80	I. P.	80
Gram	" "	2	I. P.	2
"	" "	6	I. P.	6
"	" "	17	I. P.	17

Crop.	Old name.		New name.	
Gram	Pusa Type	25	I. P.	25
,,	,, ,,	28	I. P.	28
,,	,, ,,	53	I. P.	53
,,	,, ,,	58	I. P.	58
Mung	,, ,,	18	I. P.	18
,,	,, ,,	23	I. P.	23
,,	,, ,,	28	I. P.	28
,,	,, ,,	36	I. P.	36
Urid	,, ,,	4	I. P.	4
,,	,, ,,	6	I. P.	6
,,	,, ,,	7	I. P.	7
,,	,, ,,	14	I. P.	14
Lentil	,, ,,	11	I. P.	11
,,	,, Hybrid	111·86	I. P. Hyb.	1
Peas	,, S.	29	I. P.	29
Linseed	,, Type	12	I. P.	12
,,	,, ,,	121	I. P.	121
,,	,, ,,	124	I. P.	124
,,	,, H	10	I. P. Hyb.	10
,,	,, ,,	21	I. P. ,,	21
,,	,, ,,	55	I. P. ,,	55
,,	,, ,,	68	I. P. ,,	68
Sesamum	,, Type	8	I. P.	8
,,	,, ,,	7	I. P.	7
,,	,, ,,	29	I. P.	29
Safflower	,, ,,	30	I. P.	30
Chilli	,, ,,	34	I. P.	34
,,	,, ,,	41	I. P.	41
,,	,, ,,	46 A	I. P.	46-A
,,	,, ,,	51	I. P.	51
Hemp	,, ,,	3	I. P.	3
,,	,, ,,	6	I. P.	6
,,	New Hibiscus		I. P. Sab	5
Tobacco (N. Tabacum)	Pusa Type	28	I. P.	28
,,	,, ,,	58	I. P.	58
,,	,, ,,	63	I. P.	63
,,	,, Hybrid	142	I. P. Hyb.	142
Tobacco (N. rustica)	,, Type	18	I. P.	18
Indian Hemp	,, ,,	1	I. P.	1

THE FIG IN RURAL AREAS

The possibilities of the fig in rural areas have not been fully explored. The reason for its slow penetration into these parts is largely due to the fact that the tree requires an annual pruning. A tree left to the whims of Nature will soon become unproductive or bear fruit of no commercial value.

In the Government Gardens at Lucknow there is a variety called Black Ischia. The fruit when ripe assumes a purple colour, is luscious and grows to the size of an egg. A single tree fetches about Rs. 5/-. Considering the space it occupies, the return is excellent.

For village planting it is one of the most suitable fruit trees for planting in closed-in areas. During the winter months it is devoid of all leaf which permit the maximum amount of sun to penetrate these enclosures—a very desirable feature.

Description.—Botanically it is known as Ficus Carica while in the language of the Province it is called Unjeer. It belongs to the Urticaceae family. The Peepal, Bargad, Goolar, Pakar all belong to the same family.

It demands very little attention, except for an annual pruning of its branches. During the months of November to February it is deciduous. As soon as the warm weather sets in the tree breaks into leaf at the same time producing fruit buds, which later set fruit abundantly.

The fruit begins to ripen in April and from this time till the end of June ripe fruits are harvested. As soon as the rains set in the fruits cease to ripen, and those that remain turn yellow and drop off.

A second crop of fruit is produced during the rainy season but they never ripen and are quite useless.

Soil, Water and Manure.—Though found growing throughout the Province, the tree will not grow to perfection in sandy soil. It prefers a tenacious clayey soil provided there is sub-soil drainage. In soils such as this it will bear the best crops.

It will not however succeed on low-lying water-logged soil and such situations should be avoided.

As soon as the fruits have reached the size of a marble, the trees must be copiously watered twice a month from now onwards until the crop has been harvested. This is the only time water will be required in normal seasons.

Propagation.—The fig is probably one of the easiest trees to raise from cuttings and it is quickly and easily multiplied by this means. "Goot" is however preferable. By this method sturdy plants can be

raised in a very short time and as these make very rapid growth, an orchard can be established quicker than when plants raised from cuttings are used.

All the growth that is taken off at pruning time can be used for cuttings. These are cut into lengths about 12 inches long and planted out in prepared beds one foot apart each way. This is done in December and plants are ready for planting out in the following July and August.

Young trees, three and four feet high, can be raised by this method within a few weeks and the advantage of such plants when compared with those raised from cuttings is self evident.

Planting.—Plants raised from cuttings in December are ready for planting out in the following July.

In sandy soil the plants should be spaced out 15 feet apart, but in rich soil, where a vigorous growth is made, the distance may be increased to 18 or 20 feet apart.

Pruning.—This operation is absolutely necessary if the tree is to produce edible fruit which will ripen on the tree. A tree left unpruned will not do this.

It is imperative to train the tree low to the ground causing it to assume a spreading habit.—(*Department of Agriculture U. P. Bulletin No. 20*).

ANNUAL CROPS FROM ONCE-SOWN WHEAT

Farmers all over the world are interested in the experiments of a Russian plant breeder who has produced a kind of wheat that comes up year after year though sown only once.

This new grain, which may prove to be the most important agricultural discovery for many years, is a cross between ordinary winter wheat and a Siberian variety of grass which has troubled farmers in many other countries besides Russia.

Wheat plus weed.—The weed has spreading roots that live and send up new shoots even after the grass itself is destroyed. The purpose of the Soviet experimenter was to combine the enduring powers of the root with the food-bearing qualities of wheat, and to this end he has worked for five years.

He has succeeded in growing three successive crops of the new plant. Bread of a superior flavour, so it is claimed, has been produced from the flour which contains more gluten than ordinary wheat flour. The plant will now be subjected to practical field trials and agriculturalists throughout the world will await results with interest.—(*The Hindu*).

QUALITY OF GHEE

Effects of Cattle Feed and Breed

Manufacturing methods and quality.—Experiments which make it possible to determine the quality of ghee, and to distinguish genuine ghee from adulterated mixtures or pure substitutes have lately been completed at the Imperial Dairy Institute. Because of the modern methods of hydrogenation and oil fat refining, the solidity grain structure, colour, taste and aroma do not now-a-days, completely guarantee the purity of any sample, the only other alternative is to depend upon what are called the physical and chemical constants of ghee such as its Reichert value, Iodine value etc., which though variable, ordinarily lie within certain limits, depending chiefly on the feed and breed of the cattle. Reichert value indicates the extent to which volatile water, soluble acids are present while Iodine value gives the percentage of iodine with which the unsaturated acids of fat can combine.

Five pairs of Sindhi cows, all healthy and in early lactation, were selected for the experiments. The animals in each pair were more or less similar in weight and milk yield. All were taking a concentrates ration of 36 per cent of wheat bran, 18 per cent each of groundnut cake, gingili cake and gram husk, and 10 per cent of crushed Bengal gram.

Experiments with food.—The experimental food was made up in equal ratio of wheat bran and oil cake only. Cakes of groundnut, gingili, linseed, cotton seed and cocoanut respectively were used for the different groups. Samples of butter and ghee were prepared from the milk of each animal, one just before the experinent and again twice at intervals of ten days. The analytical constants were calculated in all cases, according to approved methods and tabulated and examined.

For comparison, 15 days after the first experiment, a second experiment was performed on one of the groups, and oil cakes from the concentrated mixture were replaced by carbohydrates. The new mixture was made up of 40 per cent of wheat bran, and 20 per cent of each of crushed wheat, crushed oats and barley.

The results show that groundnut, linseed, gingili cake and cotton seed increase the Iodine value and decrease the Reichert value while cocoanut cake decreases the former without any appreciable effect on the latter. Oil cakes on the whole bring down the carotene and vitamin A contents of the butterfat, which constitute its nutritive value, while foods rich in carbohydrates increase them.

It was also noticed that the composition of the milk fat of animals fed on oil cakes tends to become similar to that of the oil. The texture is affected, gingili cake producing a soggy soft butter and ghee. Cocoa and linseed improve the quality of the butter but impart an oily flavour to the ghee.

Breed and Butter.—To determine the effects of breed on butter and ghee, two Murrah buffaloes and a pair of cows of each of the four breeds, Ayrshire, Cross-bred, Sindhi and Gir were maintained for four weeks under identical conditions with regard to housing, cleaning, exercise, feed etc. Thereafter, at intervals of a week, six lots of samples of butter from each breed were prepared and their analytical constants determined.

The results show that the several constants depend on different breeds but not appreciably on individuals of the same breed, the foreign breeds, transferring more carotene from the feed to the fat than the Indian breeds, but under ordinary working conditions in India, Sindhi butter proved in the long run superior to foreign butter in firmness and flavour.

A study was also made at the Institute of the effects of the methods of preparation of butter and ghee on their analytical constants. Butter is prepared in India either by the cream process or by the curd process. In the former, cream is separated from milk, ripened with or without a starter and the butter churned in a barrel churn. In the latter process, milk is curdled with an inoculum of the previous batch and the butter churned in an indigenous churn known as the paddle churn.

Again, ghee is prepared either by the decantation process or by the method of boiling off of moisture. In the first butter is gently heated and the fat layer carefully drawn out, when the curd layer has congulated. The moisture then is evaporated by further heating. The second method by which the butter is heated on a gentle fire until all the moisture is boiled off and the curd partially fried is the widely practised one in India.

Curd process Butter.—The experiments show that the curd process butter is richer in colour and flavour and the ghee firmer in texure, than cream process butter and ghee. But the physical and chemical constants are not appreciably affected by the method of preparation, provided it is hygienic.

The following figures compiled from the experiments of the Imperial Dairy Institute and the data collected by previous workers in the field give the limits of variation of cow and buffalo ghee and may be of interest to the scientist and large scale manufacturer.

	Cow Ghee	*Buffalo Ghee*
Reichart value	not less than 28	not less than 30
Polenske value	1.5 to 3.0	1.5 to 3.0
Kirchner value	not less than 19	not less than 25
Iodine value	26-38	30-38
B. R. reading at 40°C	40-46	40-46

It does not necessarily follow however that any sample within the above range is genuine or one without, adulterated. All available information about the history of the sample should be obtained and considered with all constants before an opinion is expressed.—(*The Hitavada, Sunday, April 28, 1940*).

HORTOMONE A FOR THE ROOTING OF CUTTINGS

Hortomone A manufactured by the Imperial Chemical Industries is a synthetic preparation developed by Imperial Chemical Industries Limited for stimulating and accelerating the formation of roots in cuttings.

Plant physiologists have recently found that minute quantities of certain chemical substances called plant 'hormones' or 'auxins' stimulate the production and growth of roots.

Hortomone A has the properties of these hormones and its effectiveness has been demonstrated both in the laboratory and in the field by collaboration with practical nurserymen.

The principal use of Hortomone A is for the treatment of plant cuttings which depend for their successful development upon their ability to put out vigorous roots before they are attacked and destroyed by fungi and bacteria.

It is almost impossible to get cuttings from certain plants to root, others can only be grown under the most exacting conditions, but even with cuttings which root easily many fail to 'strike' in spite of every attention. This is a source of disappointment to the amateur gardener and a financial loss to the professional nurseryman.

The use of Hortomone A increases the percentage of successes in plants commonly propogated by cuttings. It enables cuttings which normally strike with difficulty to be grown with ease and ensures stronger and more vigorous plants.

The effectiveness of Hortomone A for many plants has been proved by careful experiments at Jealott's Hill Research Station and elsewhere by the co-operation of the proprietors of Knap Hill Nursery, Ltd, Woking, Surrey and Messrs John Waterer, Sons and Crisp, Ltd., of the Floral Mile, Twyford, Burks. In each experiment careful comparison was made between treated and untreated cuttings, set out under conditions which were otherwise identical.

Directions for use.—Hortomone A is a very active preparation and must be diluted with water before use, only freshly diluted solution should be used. For the treatment of cuttings 1 part Hortomone A should be added to 320 parts, equivalent to ½ fluid ounce (1 table-spoon) per

gallon or 1 teaspoonful per quart. Although this strength is recommended as normal some plants may be found to respond more readily to a weaker and others to a stronger concentration. In general soft cuttings require somewhat lower concentration than woody types.

Strengths below 2 tablespoonfuls are likely to be ineffective, whereas strengths above 2 tablespoonfuls per gallon may prove harmful.

Two methods of applying Hortomone A to cuttings have been found practicable.

(1) Take the cuttings ready for insertion in the rooting medium, bunch them together and stand them in the dilute solution of Hortomone A to a depth of one inch or so for about 14—18 hours. Any convenient vessel may be used. After the period of soaking (quite conveniently overnight) remove the cuttings from the Hortomone A solution rinse them in water to wash off the surplus solution, and set them out in the ordinary way.

As little time as possible should be allowed to elapse between taking the cuttings and immersing them in Hortomone A solution. After treatment the cuttings should be set out without delay.

To ensure the maximum activity do not use the same solution twice, but make up fresh material for each batch of cuttings.

On planting out the cuttings no further treatment other than that which they would ordinarily receive.

(2) Alternatively the cuttings may be planted out in the usual manner and the beds thoroughly watered. Then make up a solution of 2 tablespoonfuls of Hortomone A per gallon and water it into the beds at ½ pint per sq. ft. Syringe (not water) the foliage with plain water to remove any solution. Thereafter the cuttings should receive normal attention.

Method 1 is recommended where possible but either method may be applied to cuttings whether set up in frame or house, with or without heat, or in the open ground.

Hortomone A may be used at any time of the year for hard or soft-wooded cuttings and evergreen or deciduous plants.

Prices.—The following are standard packages of Hortomone A. Prices are applicable in Great Britain and Northern Ireland and are subject to alteration without notice.

16 oz. bottle	21/-
8 oz. bottle	12/6
4 oz. bottle	7/6
2 oz. bottle	4/-

Instructions for use on every bottle.

FRUITS AND VEGETABLES

The average adult requires 2,400 to 2,700 calories per day. It is estimated that an average vegetarian family gets 240 calories per pound of the vegetables they use ordinarily.

Fuel values of fruits and vegetables are less than cereals but compare favourably with that of milk. In fact the lower food-value is an advantage in that it could be eaten in large quantities without causing constipation. Besides the fruits and vegetables give bulk to the food residue and prevent constipation.

Fuel value.

Lettuce and cucumber	...	100 colaries per lb.
Sweet potato and sweet corn	...	450 "
Melon	...	60 "
Banana and plums	...	350 "

As regards vitamins each fruit and vegetable has its own special property.

Vitamin ' C.'—Apple, Lettuce, Banana, Grape juice, Lime juice, Orange and Mango.

Vitamin ' A.'—Mango, Spinach, Carrot, Beans, Sweet potatoes, and Green peas are rich in Vitamin A.

Vitamin ' B.'—Most vegetables including leaves and roots and tomatoes are a potent source of Vitamin B. It is not necessary for our people to depend on toddy for Vitamin B.

Blending of different dishes is an art; for instance starch rice with a starchy vegetable or meat with a proteid vegetable is wrong.

It is necessary to make up a food in a systematic manner based on the needs of development of the human body. It is not enough if we eat to fill our stomach.

We can get all essential mineral substances required for body-building from vegetables, sugar from fruits and fats from pulses.

"An apple a day keeps the doctor away." If this is true, then a mango a day should make people in India mighty as the mango contains eight times the vitamins contained in the apple.

An enquiry made in Bombay showed that people were getting less than an ounce of fruits and vegetables per day.

The diet of school-children should contain increased fruits and vegetables.

Some fruits are cheaper than cereals. Use of fruits among masses should be encouraged. At present it is restricted because

(1) Lack of knowledge of its food value due to backwardness of education.

(2) Lack of organization to distribute it properly.
(3) Restricted cultivation due to no demand.
(4) Absence of means to conserve surplus.

But the position is slowly changing. Some section of people are creating taste for fruit and vegetables. Fruits should not be considered mere luxury of the rich. Large quantities of fruits are imported.

In India area under fruits and vegetables is 5.2 million acres. In addition to this fruit and its products worth 18 million rupees are annually imported.

Efforts are being made to try experiments with fruit trees. A number of experimental farms have been started in India.

Improvement in grading and packing are being effected. Transport companies are giving all facilities in distributing fruits and vegetables quickly and safely. Canning factories and cold storage are being established. You hear slogans "Eat more fruit."

We see more fruits and vegetables in the markets these days.

In Japan there has been the 'nutrition revolution.' Nobody to go without fruits and vegetable meal in the country.—(*Poona Agricultural College Magazine, Vol. XXX No. 1, July 1938.)*

NOTICE

The Nagpur Agricultural College Magazine

It is proposed to bring out the July issue of the Magazine as a '***Students***' number. The students of the College are requested to contribute articles to this issue on subjects bearing on ***Agriculture, Village Improvement etc*** :—

All contributions should reach the undersigned before the 10th June 1940.

Two prizes of Rs. 10/- and 5/- will be awarded to the contributors of the best articles.

Sd/- K. S. S. Iyer,
Treasurer and Business Manager,
for Editor.

College and Hostel Notes

Honour to the Alma Mater.—It is our unique privilege this time to have the opportunity to congratulate a number of our past students, who have recently distinguished themselves in life, and have thus brought honour to their Alma Mater. Dr. V. G. Vaidya after a brilliant career in the College, went abroad for further studies, where he was awarded the Ph. D. degree by the Bristol University. He now enriches our College Staff as Assistant Professor of Agriculture. We trust that as a member of the staff he will have the same measure of success as he has as a student of this College.

Mr. B. B. Dave, L. Ag. Officer in-charge of the Rice Research Scheme at Raipur has been awarded the M. Sc. degree by the Nagpur University for his work on rice cultivation. He thus gets the honour of being the second M. Sc. (Agr.) of the University. Rao Bahadur D. V. Bal, our Agricultural Chemist being the first to get this honour. We hope that this timely appreciation of Mr. Dave's labours by the University will sustain him in tackling a host of the problems of rice cultivation which may prove of immense value to the cultivators.

Mr. M. G. Kamkholker B. Sc. (Agr)., a graduate from our College has been recently placed in charge of the statistical work in H. E. H. the Nizam's Dominions, after receiving training in statistical work at the Statistical Laboratory, Calcutta. The development and application of statistical methods in India are comparatively of recent origin. There is therefore a very wide scope in this sphere for an intelligent and hard worker; we trust that Mr. Kamkholker will make valuable contribution to the same.

Another old student of our College Mr. V. S. Gokhale, L. Ag. (Hons)., who has devoted himself to agriculture in his own village has recently published a book on Volley Ball. This book has been very well received by the press and the public. The game of Volley Ball has made its appearance on the sports fields in India very recently and bids fair to get into the front ranks in the near future. This is due to its cheapness and the possibility of playing it almost all round the year. Mr. Gokhale's publication which explains the rules of the game, and introduces lively discussions on the various methode of attaining proficiency in the game, and developing the team work, will therefore serve as a timely guide to the large number of persons interested in the game. Similarly the choice of the medium i. e. Hindi in which the book has been written is therefore very happy.

The College Examinations.—As the examinations approached nearer most of the students were engaged in serious study. The Intermediate Examination results of this year are remarkable for the largest number of students who have obtained first division. This is unprecedented in the history of the College.

The College Hostel.—The hostel has this year the good fortune to shelter the College itself. But our worthy Principal Mr. E. A. H. Churchill, with great inconvenience to himself, accommodated the College Office in the minimum space. His constant presence so near us has benefited the residents immensely.

"Out of evil comes good." The whole of Nagpur is awfully frightened due to water scarcity, but this adversity has indirectly benefited us most, as that bane of our existence in the College Hostel—the Pail Depot has been abandoned temporarily atleast. Let us hope that the advent of the rains does not bring our erstwhile neighbour back to us.

NAGPUR UNIVERSITY EXAMINATION RESULTS, 1940

The following students are declared to have passed at the Intermediate Examination in Science (Agriculture) held in March 1940 in the divisions noted against their names:—

Jagannath Hota ...	1	V. S. Barker ...	2
J. P. Shrivastava ...	1	W. R. Chaurey ...	2
B. B. Misro ...	1	W. L. Agarkar ...	2
S. R. Chopde ...	1	G. L. Arzare ...	3
S. R. Palnetkar ...	1	K. R. Sarambekar ...	3
P. M. Ingley ...	1	P. N. Gawande ...	3
A. M. Deshpande ...	1	Syed Kifayatullah ...	3
R. G. Kelkar ...	1	W. D. Sawargaonkar ...	3
Ajit Singh ...	2	G. S. Sinhal ...	Pass
B. B. Banerji ...	2	K. C. Nema ...	"
M. Ganpat Rao ...	2	Mohd. Sayeedullah Khan ...	"
M. G. Mohoni ...	2	S. A. Stevenson ...	"
M. P. Dwivedi ...	2	S. B. Thawle ...	"
Mohd. Bilal Khan ...	2	S. A. Husain ...	"
P. T. Rajkondawar ...	2	B. S. Chauhan ...	"
R. P. Deshpande ...	2	*(Under Ordinance No. 20)*	
R. L. Agrawal ...	2	B. G. Wakhale ...	3
R. S. Raghuvanshi ...	2	S. S. Phadnaik ...	3
R. T. Ghodimarey ...	2	R.G. Limsay ...	Pass
Trilochan Singh ...	2		

(Under Paragraph 12 of Ordinance No. 17)		M. V. Lele	... Pass
K. K. Bhargava	... Pass	R. B. Jalit	... „
K. M. Singh	... „	S. S. Khokle	... „

Sir Arthur Blennerhassett Memorial Medal is awarded to **Jagannath Hota,** for standing first at the Intermediate in Science (Agriculture) Examination of 1940.

The following students are declared to have passed at the B. Sc. (Agr.) Examination held in April 1940, in the divisions noted against their names.

G. R. Shirpurkar	... 1	A. N. Rokde	... 3
Abdul Wali	... 2	C. M. Kekre	... 3
Asgharali Raja	... 2	H. N. Das	... 3
D. C. Jain	... 2	N. P. Shrivastava	... 3
G. P. Chaubey	... 2	R. K. Shukla	... 3
H. S. Thakur	... 2	R. N. Tiwari	... 3
J. P. Nema	... 2	S. N. Sakalley	... 3
K. R. Sahasrabudhe	... 2	S. S. Tomar	... 3
M. M. Gupta	... 2	B. W. Lakhe	... Pass
M. R. Banpurkar	... 2	D. R. Vaidya	... „
R. V. Gumasta	... 2	R. S. Kachwaha	... „
V. B. Mandlekar	... 2	R. C. Deshmukh	... „
V. W. Deshpande	... 2	V. P. Avadhoot	... „
		Y. V. Salpekar	... „

Under the provisions of Paragraph 11 of Ordinance No. 18, the following examinees are declared eligible to present themselves at one or more subsequent examinations, only in the subject noted against their respective names :—

H. N. Soni	... Botany and Plant Pathology
P. K. Mukerjee	... Botany and Plant Pathology
S. A. Joshi	... Botany and Plant Pathology

1. **Sir Arthur Blennerhassett Memorial Medal** is awarded to **G. R. Shirpurkar,** for standing first at the B. Sc. (Agr.) Examination of 1940.

2. **Chakradeo Memorial Medal** is awarded to **G. R. Shirpurkar** for obtaining the highest number of marks at the B. Sc. (Agr.) Examination of 1940, from among the examinees admitted to the examination for the first time and placed in the first division.

THIRD YEAR PROMOTION EXAMINATION, 1940

The following students have been promoted to the fourth year class.

K. S. Krishna Rao
B. C. Pradhan
Babulal Nema
S. L. Patni
S. R. Abhyankar
S. K. Gangrade
R. S. Chouhan
M. K. Shingarey
W. P. Sole
R. P. Jyotishi
S. L. Shrivastava
S. L. Gadwe
K. K. Bhargava
M. K. Oke
K. P. Lele
P. C. Verma
R. N. Bhargava
D. K. Sohoni
B. K. Zinjarde
R. S. Mehta
D. P. Keote
M. V. Lele
P. S. Thakur
P. C. Khare
P. V. Deo
A. D. Kane
V. V. Gokhale
M. V. Kothekar
S. S. Khokle
V. L. Golhar
K. M. Singh
S. P. Chitnavis
M. H. Huddar
G. D. Hishikar
R. B. Jalit
H. S. Dabir

FIRST YEAR PROMOTION EXAMINATION, 1940

The following students have been promoted to the second year class.

P. S. Parsai
B. L. Nayak
G. S. Powar
R. C. Jain
N. R. Sohni
D. D. Shukla
G. A. Aparajit
G. T. Saoji
S. N. Khutate
R. T. Desai
Laxman Pande
M. N. Durge
D. L. Potfode
P. S. Pimpalgaonkar
A. V. Bakshi
N. K. Chitnavis
M. P. Shrivastava
B. L. Rahangdale
M. S. Sonwalkar
K. J. Deshpande
B. B. Vyas
C. V. Gaikwad
S. A. Kaptan
V. D. Barve
L. G. Kolte
G. P. Kokardekar
R. N. Saksena
N. R. Maharanwar
A. K. Moharikar

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Editorial Notes

REHABILITATION OF THE CO-OPERATIVE MOVEMENT IN BERAR

The co-operative movement in Berar is passing through a very critical period at the present moment. Nearly half of the primary societies are under award or liquidation, and almost the whole of the amount due from them is long overdue. The balance sheets of the twelve leading Central Banks disclose an alarming position. They are altogether showing a deficit of Rs. 16.14 lakhs. Excepting three of these banks which could just balance their incomes and expenses, the others were running at a total yearly loss of Rs. 2.7 lakhs. This was the position on 30th June 1938. Since then it has definitely gone worse. These banks found most of their working capital frozen as the debtors could give nothing but their lands. Hence lands extending over 49,000 acres came in the possession of these banks, and the paucity of their liquid assets ultimately compelled them to close their doors. The co-operative movement in Berar was thus called upon to face a major banking crisis.

The principal causes which brought about such a position as pointed out by the Berar Co-operative Enquiry Committee are :—

"(1) Heavy financing before and during the boom period and more on the basis of assets than on the paying capacity.

(2) Failure to strike the overdues on the head, the moment they appeared.

(3) Speculative reliance on a possible appreciation of land value and lifting of the cloud of depression in the near future.

(4) Fall in the values of lands beyond all expectations. As a corollary to fall in values of land, the letting values also have gone down, thus adversely affecting the banks which had large areas of land to lease out.

(5) Interlocking of the short-term capital derived from deposits in the purchase of lands which now form the bulk of the assets of the banks.

(6) Fall in cash recoveries partly owing to depression and partly owing to factions and mischievous propaganda, and partly owing to deliberate withholding.

(7) Income from land is negligible, being not sufficient even to pay land revenue.

(8) Many banks are reduced to such a strait that they depend upon borrowings for their annual expenditure for payment of deposits and interest thereon, for land revenue and for their contributions to central institutions such as the Berar Co-operative Institute.

(9) Dependence upon the Provincial Bank for financial accommodation. So long as it was forthcoming, banks could carry on; and the moment it was withdrawn the crash came.

(10) Concentration of large loans in the hands of a few borrowers. From the Annual Report on the working of the Co-operative Department for 1937-38, it appears that 15.3 per cent of the borrowers have monopolised 80 per cent of the loans, and 175 persons owe the large sum of Rs. 19.96 lakhs.

(11) The unfortunate importation into elections of party factions and sometimes even of communal spirit.

(12) Non-co-operative action of the members themselves who tried to defraud the societies by disposing off their land, creating encumbrances on it, forming local combines to boycott auctions, and various other non-co-operative devices."

The Provincial Government was quick enough to interest itself with the situation, and it showed this by the appointment of a committee (popularly known as the Gole Committee) whose function was to suggest measures to be adopted by the Government.

The scheme propounded by the Committee mainly relied on finances to be raised by running a lottery of all the lands in the possession of the banks. The Committee also recommended the conversion of the present deposits into debentures for a term of 30 years, the principal and interest of which should be guaranteed by the Government. The Committee pointed out that its essential recommendations should be considered as an organic whole. However the expedient of lottery though unusual in the field of co-operation was quite unacceptable to the Government. The lottery scheme would involve the sale of lakhs of tickets and ultimately it would pass the lands in the hands of absentee owners, which is quite undesirable. The scheme had therefore to be shelved.

Any scheme which has to be formulated must consider the various interests which will be affected differently. It will be, firstly, the creditors (including the Provincial Co-operative Bank) who have to suffer the immediate loss. Efforts must be made to secure to them the largest possible part of their investments.. Further, in any material help which the Government gives in the form of direct financing the burden has to be ultimately borne by the general tax-payer. Hence such help will always have to be limited. Another great interest whose welfare is the most predominant in this issue, is the co-operative movement itself. To this is linked the fortune of the Indian cultivator. If the movement in Berar is unable to rehabilitate itself, and has to end itself by liquidation of the Central Banks, it will surely shake the whole superstructure of the co-operative movement in this country to its very foundations. No co-operative bank will then be able to count on capital from private investors. As its influence wanes the monopoly of the usurious moneylender is re-established and

his grip on the ryot is tightened. At any rate, this course is frought with dangers such as this and has therefore to be avoided, and the movement has to be rehabilitated. The scheme must therefore contain some features which in due course will enable the movement to put its own house in order and will help it to establish its essential position in the Indian Village Economy.

The Provincial Government after a great deal of deliberation with the experts in this country has now been able to place in the hands of the various interests concerned a definite line of action which is expected to make all possible accommodation for them. It consists of bringing about a compromise or arrangement between the creditors to the effect that the present liabilities of the bank owing to them will be scaled down.

The Co-operative Societies Amendment Act of 1940 empowers the Registrar, Co-operative Societies, to call meetings of creditors and put before them the terms of compromise or arrangement. If creditors, not less than three fourths in the value of the creditors present, agree to any compromise, the Registrar may confirm it, and this compromise will then be binding on all the creditors. This arrangement will mostly include the payment pro-rata of the present liquid assets of the bank to the depositors. The Registrar will undertake to examine the affairs of each bank with a view to ascertaining whether any scheme of rectification or rehabilitation can be devised. The members of the co-operative societies may be allowed to spread their repayments over a period of 20 years, and the lands which they desired to cultivate may be handed over to them. As a proof of its interest in the movement the Government has promised a grant of one lakh of rupees for three years in the first instance, to meet the deficit in the working of the Central Banks. A guarantee of interest to the extent of 3% on the sums due to the creditors, after conciliation is also promised.

A recent resolution of the Government on the progress of the above scheme shows that there is a general agreement on the essentials of the Government proposals regarding the compromise.

All the Central Banks excepting the Yeotmal Central Bank have agreed to the fundamental terms. The Yeotmal Bank has formulated its own scheme.

We are now in a position to say that the solution presented by the Government is by far the most suitable that could be devised, to avert the crisis and to rehabilitate the movement. It has the virtue of being able to balance the varied interests at conflict with each other. The measure of success that it will attain is largely dependent on the future trend of economic and natural forces governing the agricultural conditions in Berar.

Original Articles

SUMMARY OF RESULTS OF AN INVESTIGATION INTO "THE PHYSICAL, CHEMICAL AND BIOCHEMICAL ASPECTS OF MANURED AND UNMANURED PASTURE LAND"*

K. G. Joshi, M. Sc. (Agr.)

(*Lecturer, Agriculture College, Nagpur*).

Results of an investigation into the physical, chemical and biochemical aspects of manured and unmanured pasture land have been given.

A brief description of the various experimental plots.—A field experiment, consisting of two series was laid out in a grass area at Nagpur in the year 1931. In one of the two series (each consisting of sixteen plots) the grass grown was the 'usual local type,' growing naturally in the area, whereas plots from the other series were reseeded with the Economic Botanist's grass mixture containing different grasses and legumes. These series are referred to in this paper as 'Local Grass' and 'Botanist's Grass' series, respectively.

Manurial treatments accorded to the various plots were as follows: (i) Unmanured or control (ii) Ammonium sulphate at the rate of 100 lbs. per acre per annum (iii) Super phosphate at the rate of 200 lbs. per acre per annum (iv) Ammonium sulphate and Super phosphate at the rate of 100 lbs. and 200 lbs. per acre per annum respectively.

* Thesis submitted to the Nagpur University for the degree of M. Sc. (Agr.)

Preliminary mechanical and chemical analysis of the soils of the various plots.—In the first instance, mechanical analysis of samples of soils from each of the thirty-two plots taken to a depth of 4″ to 9″ according to the nature of the soils, was carried out. Results of analysis indicated that there is no appreciable variation in the mechanical composition of the soils within each of the two series except in the case of only a few plots. The soils from the 'Local Grass' series is generally somewhat lighter than that from the 'Botanist's Grass' series.

Chemical analysis of samples of soils prepared by mixing equal quantities of soils from the plots representing a particular treatment, was next carried out. From the results of analysis it was observed that the manurial treatments had not in any way affected the nitrogen, phosphoric acid and exchangeable calcium content of the soils from either of the two series.

This finding, however, appeared at first sight to be somewhat peculiar, particularly in respect of the phosphoric acid content of soils not receiving any phosphatic fertiliser and that of the soils receiving superphosphate equivalent to as much as 240 lbs. of phosphoric acid per acre during six years of the experiment.

Actual calculations, however, show that the results obtained were not very surprising. Assuming that the weight of the soil to a depth of six inches is about two million pounds per acre, the quantity of phosphoric acid added should have ordinarily shown an increase in the phosphoric acid content of the treated soil by about 0.012 per cent, which is not easily detectable, since the limit of experimental error as observed from the analytical data is almost of the same order, namely — 0.01 per cent. This shows that in a composite sample taken to a depth of six inches it would not be possible to detect such a small variation in the phosphoric acid content of the soil as a result of the fertiliser treatment.

Various investigators have shown that soluble phosphoric acid is rendered insoluble as soon as it comes in contact with a soil and a major part of the added soluble phosphate is fixed in the surface two to three inches. It is possible, therefore, that the analysis of the samples of soils taken to smaller depths may indicate differences if any in the composition of the various soils. Samples of soils from every inch depth were, therefore taken and employed for detailed investigations, important results of which are summarised below:—

1. **Phosphoric acid content of the soils and the grass.**—Applications of super phosphate either alone or in combination with ammonium sulphate increased the total available phosphoric acid content of the soil in the

top one inch layer to an appreciable extent, but there is no such appreciable increase at lower depths.

2. 'Local Grass' soil in general shows a higher percentage of total phosphoric acid than that in the 'Botanist's Grass' soil, a fairly high proportion of which has been found to exist in the form of phosphates of calcium.

3. Practically the whole of the soluble phosphoric acid added to the soil has been found to be fixed in combination with calcium, in the top one inch layer, while only a part of the added phosphoric acid is fixed in the citric acid soluble form.

4. Applications of phosphatic fertiliser increased the yield of grass from the 'Local Grass' series, but they did not, however, increase the phosphorus content of the grass from either of the two series.

5. A positive correlation between the amount of available phosphoric acid present in the soil and the phosphorus content of the grass grown over it, has been observed.

Total exchangeable bases and exchangeable calcium.—The manurial treatments have not appreciably altered either the amount of total exchangeable bases or the amount of exchangeable calcium contained in the soil.

1. **Organic matter and humus.**—The organic matter content of the soil has not been much affected by the manurial treatments except in the case of the top one inch layer of the soil receiving either ammonium sulphate alone or in combination with super in the 'Botanist's Grass' series.

2. About 25 to 30 per cent of the soil organic matter is present in the form of a humus. The manurial treatments appear to have stimulated the process of humification to a certain extent.

1. **Nitrogen and C/N ratio.**—Nitrogen content of the top one inch layer of the soils has been increased by most of the manurial treatments.

2. The carbon-nitrogen ratio is about 12 to 14 in the surface soils and it narrows down to a constant figure of 10.0 to 10.5 at lower depths. Application of ammonium sulphate either alone or in combination with super-phosphate has not affected the carbon-nitrogen ratio; but super-phosphate has, however, lowered the same in the top one inch layer of the soil.

1. **Lime and potash content.**—Ammonium sulphate alone has decreased the calcium carbonate content of the soil; but no such effect is observed when it is applied in combination with super-phosphate.

2. The total and available potash content and the pH value of the soils have not been affected by any of the manurial treatments.

Nitrogen fixation.—Soils receiving various fertiliser treatments do not show any appreciable difference in the rate of nitrogen fixation, in cultural solutions containing phosphate. A considerable difference in the amount of nitrogen fixed has, however, been noted in cultural solutions with and without phosphate, indicating thereby the necessity of application of phosphatic fertiliser to these soils.

Nitrification in cultural solutions.—The fertiliser treatments do not affect markedly the nitrification capacity of the soils as seen from the results of nitrification in cultural solutions.

Nitrification in soil medium.—'Local Grass' soils show somewhat a higher nitrification capacity than that of the 'Botanist's Grass' soils. Soils from the 'Local Grass' series receiving the fertiliser treatments showed a higher nitrifying capacity than the unmanured soil throughout the entire period of incubation, although such a difference was not noticeable in the case of the soils from the 'Botanist's Grass' series.

Number of Bacteria.—The bacterial numbers in the soils of both the series did not show any appreciable variation either at the different depths examined or as a result of the various manurial treatments.

CO_2 Production.—Soils of the 'Local Grass' series show somewhat a higher carbon-dioxide production capacity than those of the 'Botanist's Grass' series. Soils from both the series receiving the fertiliser treatments show a higher carbon-dioxide production capacity than that of the unmanured ones.

TRIALS REGARDING THE CULTIVATION AND CURING OF CIGARETTE TYPES OF TOBACCO IN CENTRAL PROVINCES.

B. S. RAO, L. AG. (Hons.)

(Lecturer, Agriculture College, Nagpur).

All over the world consumption of tobacco particularly in the form of cigarettes has been rapidly increasing. Hence there has been a lot of demand for cigarette types of tobacco. The United Kingdom gives preferential rates to Empire grown tobacco, and in India itself many cigarette manufacturing companies have been started. With an assured demand and good price prevailing for this kind of tobacco, attempts are being made in various Provinces and Native States in India to find out

if possibilities exist for the cultivation and curing of Cigarette Types. Guntur District in Madras Presidency is noted for the cultivation and curing of Cigarette Types of tobacco and exports large quantities to the United Kingdom. The neighbouring Districts of Guntur also are now taking to its cultivation rapidly.

In response to a suggestion made by the Imperial Council of Agricultural Research, that under its patronage, trials should be conducted in regard to the cultivation and curing of Cigarette Types of tobacco in this Province, it was decided to conduct these trials at Nagpur and at Bilaspur. The trials were started in 1935 and in this article an attempt has been made to state the experience gained on the College Farm during the four years 1935—1939 in the above mentioned direction, with suggestions for improvements if the cultivation of cigarette tobacco should be extended in this Province.

Many cultivators have been evincing their eagerness to grow cigarette tobacco as they are told that its cultivation is highly profitable. When they are told that a lb. of cured leaf fetches a rupee or even more, it is natural that they become eager to grow this crop. It is no doubt true that tobacco leaf of excellent quality fetches sometimes a rupee per lb. but the question is whether, on all kinds of soils and under all sorts of climatic conditions, it is possible to grow leaves of excellent quality. The art of curing, which no doubt goes a long way in the quality of product obtained may be learnt by any one who is interested in the process. Even in the Guntur District itself differences in the soils, give rise to great variations in the quality of the product obtained, in the case of the same variety (vide. *The cultivation, curing and marketing of Cigarette Types of tobacco in the Guntur District. The Nagpur Agri. College Magazine Vol. XI—1936).*

A good cigarette leaf should possess the following qualities:—

1. Should be mild or should not contain much of Nicotine.
2. Should be thin in texture or should possess a fine leaf.
3. The mid-rib and veins should not be prominent.
4. Should be big.
5. Should have light green colour so that when cured it may assume a lemon yellow colour.
6. Should be free from leaf spots, curls, etc.
7. Should have good burning quality i. e., slow and evenly burning leaving a white ash.
8. Should be able to retain a certain amount of moisture and remain elastic.

The above mentioned qualities are partly inherent in certain types and are partly dependent on soil and climatic conditions.

None of the Indian Tobaccos has been found to be suitable for manufacture of good cigarettes. They are all coarse and do not cure well. The only Indian Tobacco which may be said to be the best of the bad lot is Pusa No. 28, a selected Bihar Tobacco. This by itself is not recommended for cultivation for cigarette leaf. But it has been used as a parent in evolving a hybrid from Adcock, which is one of the finest American Cigarette Types of tobacco. The Hybrid is called H. 142. It combines in itself the good quality of Adcock and the high yield and hardiness of Pusa No. 28. In the Guntur District a type known as Harrison's Special is a very popular type and in fact is universally grown.

On the College Farm three types have been under trial (1) Adcock, (2) H. 142 and (3) Harrison's Special. Seeds of the above were obtained each year from the Imperial Economic Botanist, New Delhi, as considerable natural crossing takes place when different types are grown even within reasonable distance, as on the College Farm.

The seeds were first sown in carefully prepared raised beds. Protection against sun and rain was given by placing bamboo mats, over curved bamboo strips pitched over the beds (Fig. 1.)

Nursery beds were 3 feet wide and 8 feet long. Quarter of a teaspoonful of seeds was sufficient for one bed. The seeds were first mixed with fine soil in a ghamela and then broadcast evenly over each bed. To supply sufficient seedlings for planting an acre 8 to 10 nurseries of the above size are required.

The cultivation of the Cigarette Types differs from that of the chewing types and cigar types in many respects and these have to be carefully borne in mind to achieve success.

1. The soil should not be very rich in Nitrogenous ingredients, as the leaves become coarse and dark green in colour. Such leaves do not cure well. The mid-rib also becomes thick. Leaves with thick mid-rib will have to remain for a longer time in the curing barn at a temperature of 155° to 160° for the moisture to be expelled from the mid-ribs in the "Mid-rib Drying Stage" of the curing process. This subjection to a high temperature for a long time is detrimental to the other parts of the leaf. It is of course imperative that moisture should be completely removed from the Mid-rib. Soils, like the village sites, which on account of their being manured with night soil, are generally selected for ordinary tobaccos are therefore not suited for Cigarette Types. Top dressing with

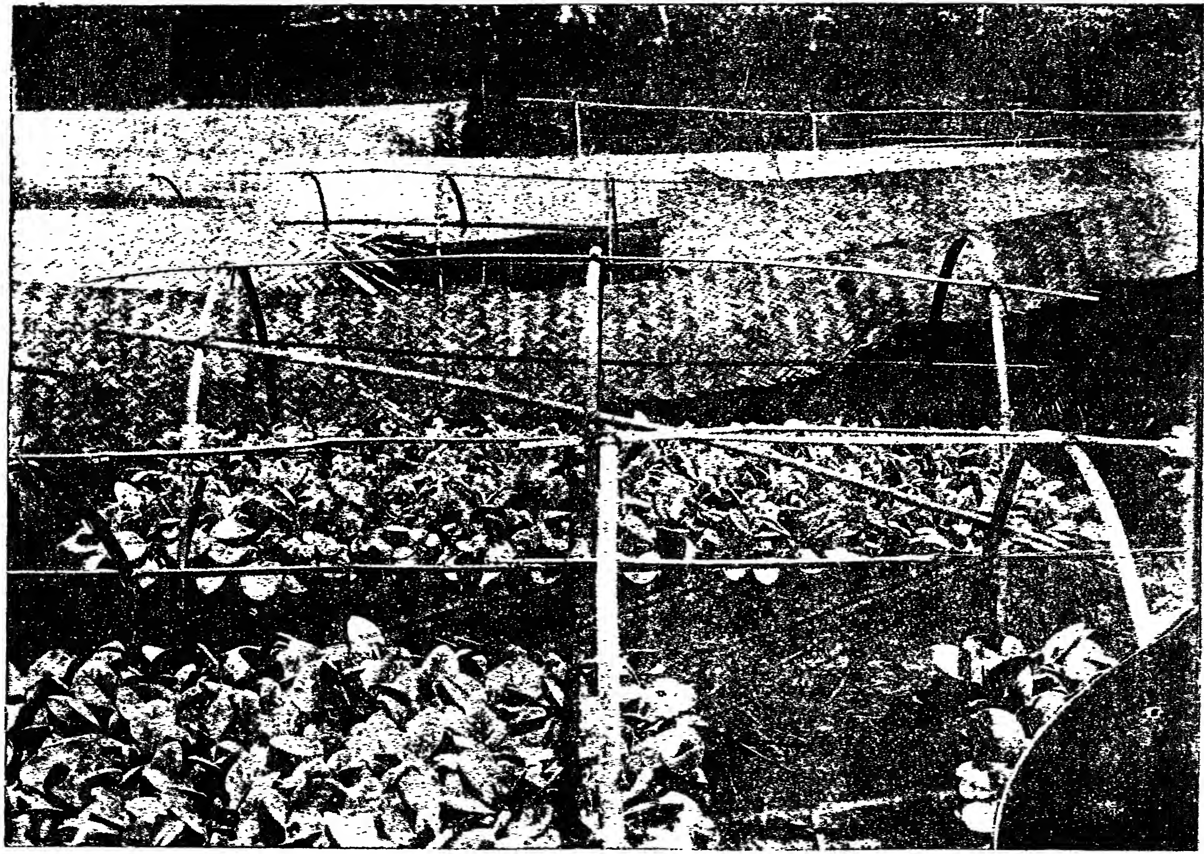

Fig. 1.—Tobacco Nursery Beds

fertilizers like Ammonium Sulphate and Soda Nitrate should be done with great discretion lest they should render the leaves coarse. The best lands for cigarette tobacco are those that are naturally rich and on which proper rotation has been observed.

2. As far as possible irrigation should be minimised particularly on heavy lands. Heavy irrigation will no doubt increase the growth of the plant, but lowers the quality. Heavily irrigated crops become coarse.

3. In the case of tobaccos in general the plants are topped, leaving only 12 to 16 leaves to develop well. These leaves become thick in texture, dark in colour and big in size. All of them attain the same size, mature at one time and are harvested together. But in the case of Cigarette Types topping should not be done. The flowering heads are allowed to develop.

4. In the case of Cigarette Types leaves are harvested in 6 or 7 instalments, as they become ready for picking, beginning with the bottom leaves. Two or three leaves only are removed from each plant during each picking.

5. In the case of Cigarette Types indications of maturity of the leaves have to be carefully understood. Only those leaves which appear yellowish green before sunrise should be plucked. The plucking should be done if possible before sunrise. After sunrise even green immature leaves deceptively appear yellow and such leaves if harvested remain green during curing and will be valued very low. Many a good leaf is rendered valueless by being plucked before it is ready by untrained pickers.

Tobacco leaves can be either sun cured, or shade cured or flue cured. It is the flue cured leaf that fetches high price and may prove remunerative. Sun curing and shade curing are not attempted unless the leaves which are ready cannot be taken to a barn for flue curing. Sun cured or shade cured leaves have a brown and unattractive colour. They are also considered inferior in other qualities to flue cured ones.

For flue curing, a specially constructed room called the tobacco curing barn is necessary. (Fig 4 and 5). This is a room in which the tobacco leaves are suspended on bamboo sticks in tiers for curing. (Fig. 6 and 7).

Fig. 2

Fig. 3.—Tobacco leaves being harvested

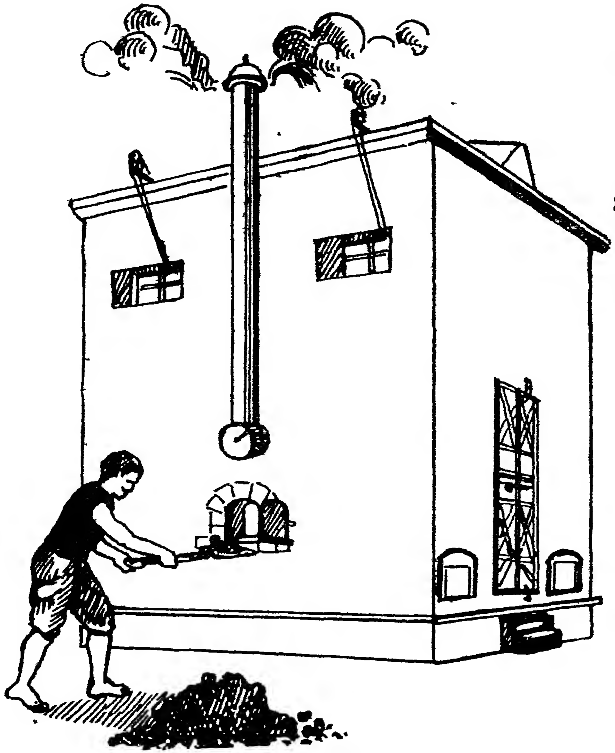

FIG. 4

Tobacco Barn

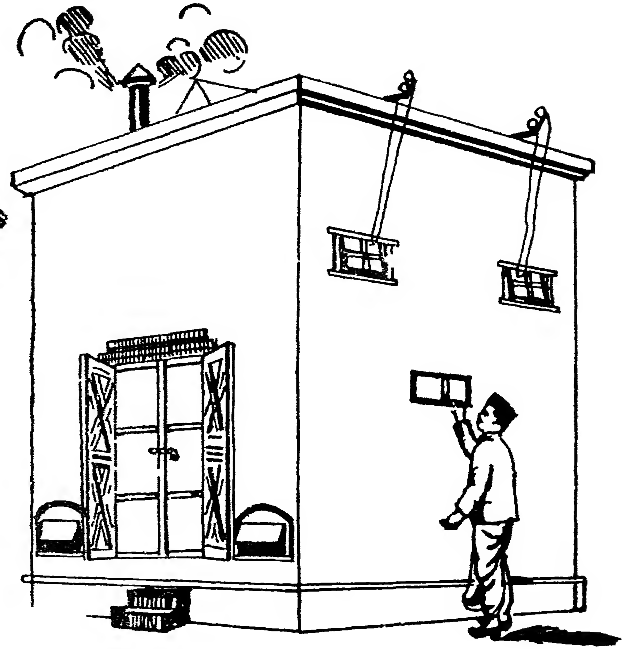

FIG. 5

The room is provided with ventilators (a) in the centre of the roof (b) at the top and (c) at the bottom of the barn by means of which the admission of air or ventilation can be controlled during different stages. The tempera-

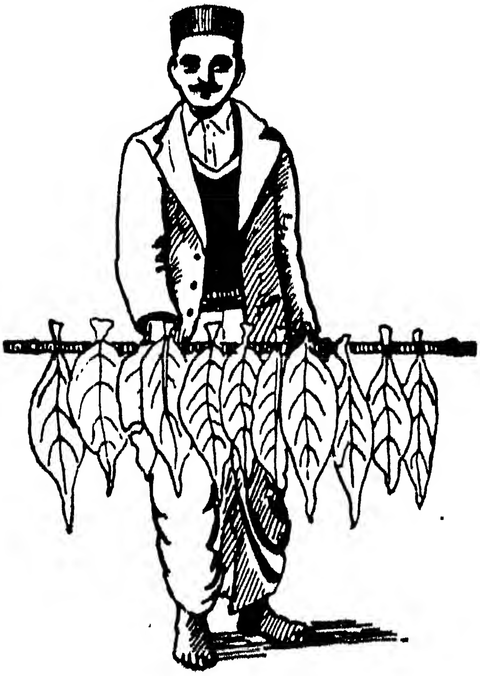

FIG. 6

FIG. 7

ture inside the barn which ranges from 78° F to 155° F is regulated by allowing hot air to pass through big iron cylinders or flues laid on the floor along the sides and the centre of the building. The air is heated as it passes through a furnace which is flushed with the wall and the fuel is fed from outside the building. The hot air after travelling through the pipes escapes through a chimney. A thermometer suspended in the centre of. the building, is brought to view near a glass window by operating a string passing through two holes in the frame work of the window. Hence the temperature prevailing inside the building is noted from time to time so that the heating in the furnace may be controlled.

A barn of the type built on the College Farm (Pusa type) with the furnance, flues etc. costs Rs. 1,500/-. The inside dimensions are 16½' x 16' x 16'. For a detailed account of the building and the process of curing readers are requested to refer to bulletin No. 187 of the Imperial Council of Agricultural Research, New Delhi or to an article titled, *'The cultivation, curing and Marketing of Cigarette types of tobacco in the Guntur District'* by the present writer in *Vol. No. XI—1936 of this Magazine.* The barn

on the College Farm is provided with verandahs on all sides to render the building useful for other purposes also when tobacco curing is over. Rs. 1,500/- does not include the cost of the verandahs. Persons who are interested in learning the process of flue curing tobacco will do well to visit the College Farm, Nagpur, during the months of January and February every year when the curing process will be in progress. But it should not be supposed that this method is being recommended as a paying proposition. On the Nagpur and Bilaspur farms during the last five years the experiments have not proved financially successful due to several vicissitudes to which the crops have been exposed and which are explained at a later stage in this article. But in areas which are more favoured the writer is not without hopes of the enterprise proving successful.

Difficulties which present themselves before the farmer who wants to grow cigarette tobaccos are many. Some of the important ones are discussed below with suggestions for overcoming them.

In the nursery seedlings die away suddenly. This is due to a fungus which develops on account of excess of moisture near the surface of the nursery bed. It is very necessary to prevent crowding of plants. The sowing should be thin and not thick. If thickly sown patches exist then some of the seedlings should be removed carefully with forceps or a needle. If an attempt is made to pull them out with one's fingers too many plants will be uprooted. Spraying the seedlings with Bordeaux Mixture is very effective in checking the disease from spreading. It has also been observed that after being treated with Bordeaux Mixture the seedlings did not only escape the attack of the fungus, but grew quicker and stronger than those seedlings which are not treated with Bordeaux Mixture. This invigorating effect of the Bordeaux Mixture may be due to the copper contained in the Bordeaux Mixture and which finds its way into the soil. Many scientists have proved the salutory effects on plants of certain elements in very small quantities.

It is very necessary to change the site for nursery beds year after year, lest many diseases like the Virus and the Nematode which cause root knot should infect the plants even while in the nursery and lead to their failure on the field. As a precautionary measure before sowing the nursery beds should be sterilised so that the fungi and animal organisms which are in the top 9 inches of the nursery beds may be killed. This is done by heaping dry grass, cotton stalks etc. to a height of about a foot on the beds and igniting them. The heat generated will be sufficient to sterilise the top 9 inches layer of the soil. After firing it is not necessary to

remove the ash. It may be worked into the soil by means of a hand fork or a khurpi.

Generally the seeds are broadcast on fairly moist surface. With the palm of the hand or a flat brick the seeds are pressed lightly into the soil and then a thin layer of fine earth is sprinkled over the surface. Seeds take 8 to 12 days to germinate. Sometimes they germinate after even 15 or 20 days. On one accasion after having waited for 15 days, a second sowing was done under the supposition that the first instalment of seeds were bad. But a day or two later the first sown seeds germinated in large numbers. When the plants are about one inch high some fine soil should be sprinkled so that this may cover the young roots which may be exposed due to watering from above. If these roots are not covered the plant will dry. Watering should be done with a can, having a very fine rose.

The seedling should be carefully lifted from the nursery with as little damage as possible to the roots. Transplantation should be done on well prepared land. The soil should be fairly moist at the time of transplantation. By the roots being pushed into dry soil they are mutilated and the plant dries. The young plants should be protected from strong sun with caps (colches) made of teak leaves and watered by hand for about a week. Too young plants have to be irrigated at least 3 or 4 times if the transplantation is done during the end of September. An attempt has been made on the College Farm to transplant the crop in August so that there may be no necessity to irrigate the crop. It was found that the plants no doubt grew big but the leaves were coarse and many of them were damaged by the later heavy rains. As these leaves were washed by the rain they were not of good quality.

As indicated before the plants are not topped. The central shoot continues to grow and produce flower heads. As topping is not done side suckers do not appear in large numbers. But those that do occur should be promptly removed as these arrest the growth of the big leaves.

In areas where the crop grows unhampered the spacing recommended is 3 ft. between lines and 3 ft. between plants in the line. But on the College Farm as a large number of plants die due to various causes which are mentioned later it has been found necessary to keep lines 2½ ft. apart and plant to plant spacing 2 ft. Great care has to be taken during interculture not to tear the leaves.

Grasshoppers eat away the young plants particularly just after transplantation. Bagging them has been found useful. The bagging

which is done by two men running between lines dragging a cloth bag open at one end so that the grasshoppers are caught into the bag, should be done early in the morning when the grasshoppers are still on the leaves.

Many plants become stunted in growth and present a peculiar appearance. The leaves become curled, they become wrinkled. This is said to be due to Virus which may be introduced from a diseased plant to a healthy plant by various agencies. (Fig 9). The Virus may be present in dry diseased tobacco, in the soil etc. Hence it is very necessary to burn all tobacco suspected to have the Virus. Virus affected leaves do not cure evenly and are of inferior quality. In order to overcome the Virus proper rotation perhaps is the only remedy so far known. Attempts are being made on the College Farm to collect seeds from unaffected plants and see if these seeds will give rise to plants immune to Virus.

Another disease which takes a heavy toll of tobacco plants on the College Farm is the "Root Knot" disease, in which certain organisms called Eeel worms (Nematodes) enter the roots causing the root to swell and become diseased. The plants are stunted in growth or they suddenly begin to wilt and die. Such plants when pulled out exhibit the Knotted Root. (Fig 10). The organism lives in the soil. Rotation is absolutely necessary to starve these organisms.

Orbanchae (Tokra or Bhambakoo) a parasitic weed which is present on a very large scale at Guntur has not been found on the College Farm except here and there. This should be pulled out and burnt. (Fig 8).

Severe damage occurs if a hail storm should occur. The leaves are hacked to pieces. The plants lodge down and it is very often impossible to support them to stand erect. When plants lodge side shoots or suckers appear in large numbers. Hail storm caused severe damage during two years. On the College Farm, as no frost occurs, the crops are not exposed to this danger which in certain places is an annual occurrence and causes havoc. The heavy black soil of the College Farm cracks badly. When this happens many tobacco plants lodge. It is necessary to establish a deep mulch by careful intercultivation to prevent the soil from cracking. As the atmosphere is very dry the crop dries faster than desirable.


TOBACCO DLANT
Parasite
Orbanchae

FIG. 8

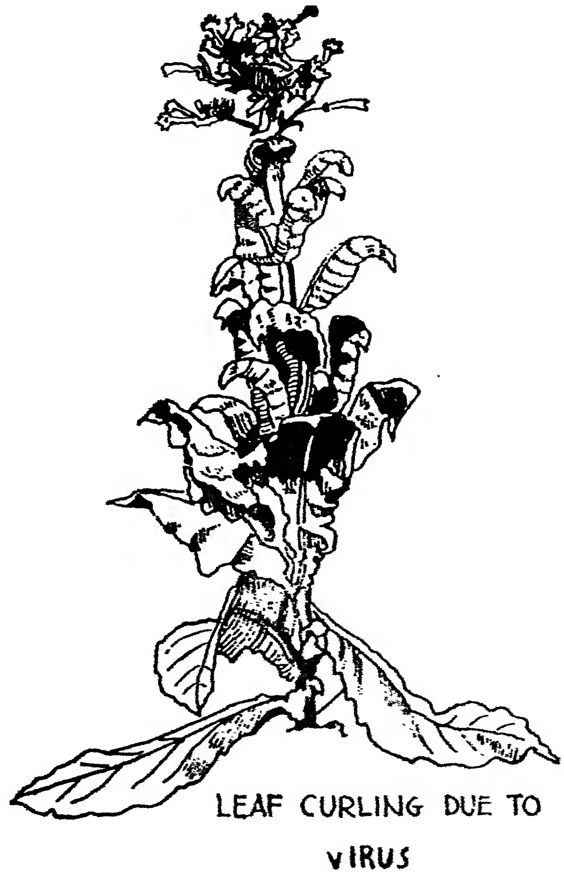
LEAF CURLING DUE TO
VIRUS

FIG. 9

FIG. 10

In order to keep a barn of the size specified above, busy, it is necessary to have 3—4 acres of tobacco crop. From one load or charge 300—350 lbs. of cured leaves are obtained. The time actually taken for a load for being cured is about 85 hours. This is less than what is necessary either at Pusa or at Guntur on account of the shorter period required for mid-rib drying but as the leaves are very brittle and liable to break during handling they cannot be taken out of the barn for at least another 48 hours during which time the inside of the barn has to be kept humid so that the cured leaves which are crisp may absorb moisture and become soft, and pliable. This artificial method of humidifying the atmosphere in the barn as well as in the rooms in which tobacco leaves are sorted, graded, hanked and stored adds considerably to the cost of curing etc. of bringing down the quality of the leaf. The leaves have to be rendered soft and pliable by absorption of moisture. This is difficult to manage as by merely opening the door and windows as at Pusa and Guntur the leaves do not become soft due to atmosphere being dry and not humid as at the two places mentioned above. Hence humidity has to be created artificially in the barn by damping the floor and the walls and suspending wet gunny cloth in front of the door. After two days of such treatment it is found that the lowermost tiers of leaves are only fit to be handled. These are removed to a room where again humidity is artificially maintained. The brittle leaves of the top tiers have to be brought down to the bottom with the sticks on which they are suspended for being rendered soft. This process takes more than 3 days during which period the leaves that are ready for plucking deteriorate on account of the delay.

On account of the dry condition of the atmosphere at Nagpur the following points have to be remembered while curing the leaves.

1. The inside of barn should be kept moist while loading.

2. No time should be lost in sorting and stringing.

3. During colour fixing stage the bottom ventilators need not be opened very much.

4. During mid-rib drying the temperature need not be raised beyond 150°F. The quality of the leaf is better when it is not subjected to very

high temperature at this stage. In Nagpur the atmosphere being very dry the mid-rib drying takes less time than in humid parts of India.

As the temperature is generally high and as the mid-rib drying takes less time the consumption of coal is comparatively less than at Pusa or Guntur. From the commencement of loading of the barn with leaves to the complete removal of the leaves from the barn the time taken is shown below.

Loading the barn	...	10—12	Hours.
Yellowing stage	...	24—36	"
Colour fixing stage	...	12—16	"
Mid-rib drying stage	...	48—56	"
Softening the cured leaves	...	70—80	"
Total	...	164—200	Hours.

The barn with the furnace and the flues costs about Rs. 1,500/- The flues have to be changed every 3 or 4 years.

Cost of growing the crop amounts to about Rs. 60/- per acre. The cost of harvesting, curing, bulking and grading works out at Rs. 44/- per barn load of 350 lbs. of cured leaf or Re. 0/2/0 per lb. of cured leaves. Assuming that the yield from an acre is about 500 lbs. cost of curing amounts to about Rs. 65/- per acre.

The tobacco stalks do not find any sale in Nagpur and hence their value has been nil.

Three types of cigarette tobaccos have been tried on the College Farm. These are Adcock, H 142, and Harrison's Special. H 142 has been doing well in Bihar while Harrison's Special is very popular in Guntur area. The performance of these on the College Farm has to be judged from the following aspects (1) Yield (2) Quality (3) Resistance to diseases like Virus, Root Knot, Mosaic etc. As the Virus disease has been very much in evidence from the very first year of the trial the yielding capacity could not be judged. But from the height of the plants which were free from Virus it has been fairly clear that on the College Farm the Adcock variety does not grow tall and produce big leaves which are necessary for high yield. H 142 and Harrison's Special both grow to the same height. Leaves of Harrison's Special do not attain the big size of H. 142, but they are slightly superior as the mid-rib is not very thick. The best quality of leaf is no doubt present in Adcock.

Regarding the quality of resistance to diseases on the College Farm all of them suffered badly. Percentage of plants uprotted and burnt on account of Virus, or Root Knot or a combination of both is in the case of Adcock—21%, Harrison's Special—23%, H 142—24%.

In 1939—40 seeds from plants which have been found to have grown healthy have been collected. These will be sown in 1940 to explore the possibilities of selecting Virus resisting strains of Adocock, H 142 and Harrison's Special.

Another possibility of avoiding Virus and Root Knot perhaps exists in not growing tobacco on the same land oftener than once in 3 years.

In one year the tobacco planting was done on a piece of land which bore a groundnut crop during the rainy season. A portion of this groundnut crop was manured with Basic Slag. The tobacco plants which occupied the area on which Basic Slag was applied were found to grow tall and thinner leaves with less prominent mid-ribs, and had a lighter colour and the plants did not suffer from leaf curling to any great extent. In view of this observation the effect of Basic Slag as a fertiliser for cigaratte types of tobacco is worth being investigated, particularly in rendering the plants immune to Virus and Root Knot.

The white fly which is said to be a Vector for Virus dissemination in other places has not been found on the College Farm.

Incidence of the above mentioned disease is not very great in places like Akola, Ellichpur, Buldana etc., where tobacco for chewing is grown on large areas. The possibilities of the cultivation of cigarette tobacco at the above mentioned places is worthy of investigation. The process of flue curing will not present greater difficulties in the above mentioned places than in Nagpur. Chances of financial success depend on growing a healthy crop having good quality leaves. Another tract in the Central Provinces where, in the opinion of the writer, the cultivation of cigarette types may meet with success is the Chanda District. The red-sandy loams with irrigation should be able to produce good quality leaves.

In the Northern Districts where frost is an annual occurrence it is useless to try these types.

The cigarette leaves obtained on the Bilaspur Farm have been pronounced to be superior to those grown on the black soils of the Nagpur Farm, by the Imperial Botanist, Council of Agricultural Research, New Delhi. On account of heavy rains it has also not been possible to plant the crop earlier during the year sothat the crop may be harvested early.

Statement showing profit and loss in tobacco cultivation on the College Farm during the years 1935 to 1940

Year.	Area under tobacco.	Flue cured leaves obtained	Value	Trash and sun dried leaves	Value	Value of tobacco stem.	Total value of the crop.	Value of produce per acre.	Profit or loss per acre.	Remarks.
		lbs.	Rs. as. ps.	lbs.	Rs. as. ps.		Rs. as. ps.	Rs. as. ps.	Rs. as ps.	
1935—36	2.32	687	278 13 0	356	13 6 0	Nil	292 3 0	126 0 0	34 0 0	Loss
1936—37	3.01	770	310 0 0	105	3 15 0	Nil	314 0 0	104 10 0	51 6 0	Loss
1937—38	2.50	620	217 8 0	230	8 10 0	Nil	226 2 0	90 7 0	69 9 0	Loss
1938—39	2.40	918	261 7 0	100	3 12 0	Nil	265 3 0	110 8 0	49 8 0	Loss
1939—40	2.40	807	295 4 0	525	19 11 0	Nil	314 15 0	131 3 0	28 13 0	Loss

Expenses per acre in the cultivation and curing of Cigarette Types are as follows :—

	Rs.	As.	Ps.
Cost of cultivation	60	0	0
Cost of curing	65	0	0
Proportionate interest and depreciation on Rs. 1,500/- invested for Barn ...	35	0	0
Total ...	160	0	0

Yields obtained on the College Farm per acre were as follows :—

1935—36 — 300 lbs cured leaves of all types put together.
1936—37 — 250 „ „
1937—38 — 300 „ „
1938—39 — 382.5 „ „
1939—40 — 335 „ „

The trash obtained is not shown in the above table as it does not substantially add to the income.

The quality of product ranged during different years as shown below :—

Grade A—41.5% to 48.8% of total leaves obtained.
Grade B—24% to 34% „
Grade C—24.5% to 27.2% „

Prices obtained per lb. of cured leaf were as follows (ex-godown Nagpur).

	1935-36	1936-37	1937-38	1938-39	1939-40
Grade A	-/8/-	-/8/-	-/8/-	-/6/-	-/8/-
Grade B	-/6/-	-/5/-	-/6/-	-/4/6	-/6/-
Grade C		-/3/-	-/4/-	-/2/-	-/2/-

Conclusion :—On the College Farm the cultivation and curing of cigarette types has been a financial loss on account of low yield and diseased condition of the leaves. This is to a great extent due to the fact that for want of alternative land commanding irrigation, the tobacco crop had to be grown on the same land without rotation. It is worth while trying these again in Berar (Buldana, Ellichpur etc.) where large areas are devoted for chewing types of tobacco. Unless the crop is free from Virus and other diseases and a minimum yield of 600 lbs. of cured leaves mostly consisting of grade A (superior leaf) is obtained the cultivation of cigarette types of tobacco cannot prove profitable.

IMPORTANCE OF SMALL DEPTH SAMPLING IN STUDIES RELATING TO THE EFFECT OF FERTILISER-APPLICATION *

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Manures and fertilisers are spread over the soil surface and incorporated by a light cultivation. In pasture lands and even in field crops fertilisers are applied as top dressing by broadcasting them at a proper time. This is followed by interculture operation in the case of field crops. Cultivation is not possible in pasture soils and the fertilisers are carried to lower depths by rainwater. A disc-harrow may, however, be sometimes used for burying the manure in the pasture land.

After continuous application of the fertilisers for a fairly long time, they are liable to bring about changes in the composition of soil. Phosphatic fertilisers which cannot be leached out accumulate in the soil and consequently increase the phosphoric acid status of the manured soil. Potassic fertilisers may react with the clay-complex and increase the proportion of exchangeable potassium in the complex. Manures and fertilisers, in general, may improve to some extent the organic matter and as a consequence the nitrogen content of the soil by promoting root and stubble growth.

In studying such effects of the fertiliser treatments on the composition of soil a common procedure adopted by research workers is to collect six-inch or nine-inch depth soil-samples, this being the usual depth of sampling for all routine laboratory work. When the quantity of manure or fertiliser applied is large and the application continued for a number of years, such deep-depth sampling may show significant differences in soil composition. But when quantity of manure applied is small, such differences in the composition of soil from manured and unmanured areas are not noted. It is, therefore, advisable to take smaller depth profile samples for such investigations. Askew, Rigg and Barter (1) have shown the importance of the depth of sampling in fertiliser studies.

Experimental.—In certain investigations in connection with manuring of pasture land, significant difference in the composition of soils from manured and unmanured plots could not be obtained in soil samples of six-inch from the same plots.

* Based upon a part of his thesis on 'The physical, chemical and biochemical aspects of manured and unmanured pasture land' submitted to the Nagpur University for the degree of M. Sc. (Agr.).

The field experiment consisted of two series, each consisting of sixteen plots, one called the "Local Grass" and the other "Botanist Grass," according to the type of grass occupying the land.

The manurial treatments (with four replications) were as follows :—

(1) Unmanured or control.

(2) Ammonium sulphate at the rates of 100 lbs. per acre per annum.

(3) Superphosphate at the rate of 200 lbs. per acre per annum.

(4) Ammonium sulphate and super phosphate at the rate of 100 lbs. respectively per acre per annum.

The following abbreviations have been used for them in this paper.

(1) Unmanured. (3) Am. Sulph.

(2) Super. (4) Am. Sul. and Sup.

The manures were applied annually for a period of six years, i. e. from the year 1931 to 1936.

Six-inch depth sampling.—Initially six-inch depth samples from different manurial treatments were obtained for some preliminary analytical work. The results of analaysis are given below :—

TABLE 1

(Analysis of six-inch-depth samples).

Treatments.	Local Grass Soil.		Bot. Grass Soil.	
	% Nitrogen.	% P_2O_5	% Nitrogen.	% P_2O_5
Unmanured ...	0.091	0.12	0.075	0.042
Am. Sulpt. ...	0.089	0.13	0.079	0.047
Super. ...	0.104	0.13	0.078	0.044
Am. Sul. and Sup.	0.090	0.14	0.082	0.050

The results of analysis given above indicate that there are no significant differences in the composition of manured and unmanured soils. This finding, however, appears to be peculiar because the soil under superphosphate treatment received as much as 240 lbs. of phosphoric acid per acre during the experimental period, very little of which was removed by the crop as could be seen from the results below :—

TABLE II

(Phosphoric acid removed by grass).

Treatments.	Local Grass.		Botanist's Grass.	
	% P_2O_5 in grass.	lb. P_2O_5 removed per acre.	% P_2O_5 in grass.	lb. P_2O_5 removed per acre.
Unmanured ...	0.51	10.5	0.28	10.7
Am. Sulph. ...	0.51	18.9	0.27	14.2
Super. ...	0.54	17.1	0.29	12.1
Am. Sul. + Sup....	0.48	16.8	0.28	15.0

Every-inch-depth sampling.—After some preliminary studies, samples of every-inch-depth from the same manured and unmanured plots, upto a depth of 4 inches, were obtained for further investigation. The results of phosphoric acid and nitrogen content are given in the following tables:—

TABLE III

(Percentage of total P_2O_5 in Local Grass Soil).

Depth.	Unmanured.	Am. Sulph.	Super.	Am. Sul. + Sup.
0 —1″	0.115	0.125	0.175	0.182
1″—2″	0.097	0.104	0.099	0.105
2″—3″	0.087	0.085	0.085	0.090
3″—4″	0.088	0.082	0.087	0.086

TABLE IV

(Percentage of nitrogen in Local Grass Soil).

Depth.	Unmanured.	Am. Sulph.	Super.	Am. Sul. + Sup.
0 —1″	0.101	0.109	0.118	0.121
1″—2″	0.079	0.073	0.085	0.079
2″—3″	0.079	0.073	0.077	0.075
3″—4″	0.073	0.070	0.074	0.069

TABLE V

(*Percentage of total P_2O_5 Botanist's Grass Soil*).

Depth.	Unmanured.	Am. Sulph.	Super.	Am. Sul. + Sup.
0 —1″	0.073	0.073	0.106	0.087
1″—2″	0.053	0.060	0.069	0.078
2″—3″	0.047	0.050	0.049	0.049
3″—4″	0.049	0.047	0.047	0.050

TABLE VI

(*Percentage of nitrogen in Botanist's Grass Soil*).

Depth.	Unmanured.	Am. Sulph.	Super.	Am. Sul. + Sup.
0 —1″	0.097	0.130	0.118	0.129
1″—2″	0.087	0.095	0.090	0.097
2″—3″	0.076	0.079	0.079	0.084
3″—4″	0.069	0.074	0.075	0.076

It is evident from the above analytical data that the phosphoric acid content of the soil from the top one inch in the case of super treatment, singly or in combination with ammonium sulphate is significantly higher than the soil from the unmanured plots. Nitrogen content of the top one inch layer of all the manured soils is higher than the unmanured.

It is thus seen that the one-inch depth samples showed accumulation of phosphoric acid and nitrogen in the surface soil; whereas the six inch depth samples failed to show such variations.

If we assume that the weight of soil per acre to a depth of six inches to be about two million pounds (5) then the fertilisers added should be expected to show an increase of 0.012 per cent of phosphoric acid in the soils. Results of analysis in Table 1, however, show that the limit of experimental error may be taken as $\pm$ 0.01 per cent, showing thereby that in a composite sample taken to a depth of six inches it would not be possible to detect such a small variation in the phosphoric acid content of the soil as a result of fertiliser treatment.

On the other hand, the weight of an acre of soil to a depth of only one inch will be about one third million pounds and if the fertiliser added accumulate in the top one inch layer, an increase of 0.072 per cent of phosphoric acid could be expected. This is much more than the plausible experimental error. It is well known that the phosphatic fertilisers get fixed up in the surface few inches (2, 3, 4) and hence it is advisable to take small depth samples in studies of this nature.

Summary.—Six-inch depth samples from different manurial treatments were analysed for nitrogen and phosphoric acid content. Significant differences in the composition of soils were not observed.

On examining every-inch-depth samples, to a depth of four inches, of the same treatments, accumulation of phosphoric acid and nitrogen in the top one inch layer was detected. This showed the importance of small depth sampling in studies of this nature.

ACKNOWLEDGMENT

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WEEDS

S. M. WAKANKAR

Two kinds of plants populate the arable land— crops and weeds. The crop plants are introduced and cultivated for economic reasons; the weeds are usually native or natural plants which migrate from their natural breeding grounds and get themselves introduced. These are the unwanted plants which spread with great rapidity and resist man's effort to combat and subdue. These are hardy and draught resistant and produce seeds in enormous numbers which remain viable for years.

From agriculture point of view the weeds are important as they cause a lot of damage to the crops. They compete with the crops in the soil, in air and for light. Both crops and weeds take up room and want the same water and the same mineral salts from the soil though in different proportions, depending on the nature of the plants concerned. Both want a full supply of light for the elaboration of food manufacturing processes in a satisfactory manner. The weeds take a larger toll than from birds, rodents and fungi. For a certain year in the U. S. A. a loss of three million dollars due to weeds was estimated.

The harm done by weeds are due to the facts that they offer serious competition to crops for food, moisture and light; they add to the cost of crop production because of the large amount of labour necessary to keep them in check; they increase the cost of preparing many crop products for consumption; they impair the quality and reduce the value of many products of soil; they harbour insect and fungus pests and they are sometimes poisonous and may endanger the health and life of man and animals.

The spread and introduction of weeds is through the natural agencies of wind and animals; they are conveyed in dirt, sand, gravel and are carried as such in baled hay, packing about trees and food stuffs; through farmyard manure if not properly composed. Lastly in the irrigated areas, the canal water is a source of great danger where the weed seeds which are mostly light are carried to the fields through this agency.

The weeds come under three categories; annuals, biennials and perennials. The annuals are gifted with rapid reproductive power that in a single season of life it produces its roots, its shoots, its flowers, its fruits, its seeds and then dies completely leaving nothing behind but numerous seeds to produce a new crop of weed plants the next season. Such annual weeds rapidly overrun a large area of ground .

The biennial weeds take two seasons to complete the life or their single generation and under normal conditions the first season is more or less completely devoted to the production of root and shoot. Surplus food is manufactured and stored up in safety to a large extent within the enlarged underground root. The shoot which manufactures all the food used by the plant assumes the form of green rosette at the ground crowning the storing root parts. The plant rests during one season. During the second year of life the bud in the centre of the leaf rosette grows up and forms a reproductive apparatus with flowers and ultimately fruits and seeds. When these seeds are scattered the plant dies from exhaustion. No food and no buds are left behind to continue the growth. Though the parent dies the numerous seeds left behind produce a new crop of biennial weeds.

Annuals and biennials are reproduced from seeds as starting points. Perennials are also spread and reproduced from seeds but these in addition can also be propagated by seed stocks. The perennial weeds form special underground living stems stored with surplus food, having buds and leaves and forming roots. This underground part is called the rhizome and when the portion above ground dies away, the rhizome with its buds, its food store and its roots still persists and remains alive. The possession of this rhizome gives the perennial weed the power of lasting and renewing its growth from year to year. If the rhizome is destroyed the life of the whole plant is at an end and if a portion of the same remains in the ground it is still capable of growth; it renews and extends its life.

The eradication of annual and biennial weeds is rather simple. The weakest point in the life of such weeds in the seedling stage. This seedling is at the change of life, the change from dependence on parental food supplies to reliance on food products resulting solely from its own activity. At this stage the lowest amount of food is in reserve. Destruction at this stage is most easy and effective. Removing of weed seedlings by hoeing, harrowing or covering them by earth by a light soil turning plough is the most practical method of eradicating the weeds of the two catagories. In any case the weeds must be removed before the seedling stage. "One year's seedlings is seven years' weeding" is a common saying.

Perennial weeds can be controlled at the first instance by prevention of seeding but as this class of weed is known to store food in its rhizomes and thus is able to carry on from season to season, this reserve food must be starved out for the complete eradication. This is done by repeated cutting of the tops and also by smother crops which cover and kill the

weeds. In this manure cyperus rotundus (motha) can be got rid off by a heavy plantation of sorghum, cowpea and berseem. The underground rhizomes of these perennials can also be removed by deep ploughing. Saccharum spoutaveun (kans) a troublesome weed on heavy lands can be effectively controlled by deep ploughing. The most practicable weed control will be through proper soil management and suitable crop rotations.

Another aspect of weed control is by the use of herbicides. Such herbicides are usually used on garden foot paths, roadsides, canal embankments and for producing fire-breaks between forests. Their cost prohibits their use on arable land. Herbicides can broadly be divided into two groups. First is the soil and second the chemical. Diesel oil mixed half and half with water and used in the form of a spray is usually effective and is used on canal embankments in the U. S. A. It is also used in that country for killing water hycinth.

Other herbicides are the sulphuric acid chlorates and arsenicals. A 5—6 per cent solution of sulphuric acid can be used to kill the annuals and prevent the seedlings of biennials and perennials. The chlorates are the best known herbicides; these are non-poisonous to animals and can be applied as a powder to the top of plants on dew. Commercial mixtures are usually made of sodium chlorate and calcium chloride, the latter is added to remove the great danger of fire hazard. The arsenicals are truely speaking the soil sterilisers. Sodium arsenite, arsenious and arsenic acids and arsenic trichloride are effective in killing weeds. One and a half gallon of stock solution consisting of (10 lbs. sodium hydroxide, 20 lbs. arsenious acid with 5 gallons of water) and mixed with 100 gallons of water is enough to treat 100 square yards. Such herbicides are used for destroying weeds on garden walls and tennis courts. Sodium arsenite is used to kill water hycinth in America and for cuscuta the use of Ferrous sulphate is common.

Extracts

PHYSIOLOGIST AND CHEMIST IN THE CLASSIFICATION OF PLANTS

By H. G. G. R.

In his recent Presidential Address to the National Institute of Science in India at Madras, Lt., Col. Chopra expressed the hope that the botanist, the chemist and the physiologist would combine to evolve a truly natural system of classification of plants, which would be of great academic and practical value. This wish has been generally expressed in recent times specially by chemists ever since the rapid advance of the science of biochemistry revealed that a close correlation exists between the chemical and physical properties of plants on the one hand and their position in the systematic classification of the botanists on the other.

The present basis for the determination of relationships among plants has been mostly the external characteristics such as the structure of the flowers, the stems and the leaves. The difficulty of observation of the minute differences as well as their inconstancy, as many of them alter according to conditions of growth, have often been a source of unnecessary controversy among botanists. Hence an alternative system in which their chemical constitutions are taken into account has been sought after frequently.

"**Stereoisomerism.**"—The line of attack in this direction has been directed towards the complex organic molecule. The starches and proteins differ from plant to plant. This distinction is enhanced by yet another important character viz., Stereoisomerism, which means simply the quality by which the same substance exists under a variety of forms, though chemically, having the same formula. Any number of such forms are possible among organic substances.

The common starch, for example, obtained from various sources as potato, rice, arrowroot, topioca, though for all practical purposes having fairly uniform properties, has been estimated to exist in thousands such forms, while some animal proteins as the serum albumin exists in no less than thousand million forms.

This peculiar characteristic of the starch substance has been exploited by an American Scientist, Reichert. Encouraged by his success on animals, where only by examining the haeomoglobins without the knowledge of their sources he could predict whether inter-breeding between the species was possible or not, and by studying other characteristics of habit, he has taken starch as a suitable medium in plants to indicate the presence or absence of relationship among species. Starch occurs universally in the

vegetable kingdom and is a special feature of plants. It is product of their vital activity and as such may be taken to be related in an indirect way to the plant substance and the species. This indirect approach, though at first sight appearing to be farfetched, has yielded fairly good results in his hands. Reichert showed a few years back, by means of the reaction curves which he constructed for starches from more than three hundred plants that relationship between plants can be predicted on an inspection of these curves which have been carefully constructed on a set of chosen reactions. He could even attempt to rectify the discrepancies in the minor groupings and conform generally his opinions with the current ones of the systematic botanists.

The "Serum Test."—A recent important work by Carl Mez of the University of Koenigsberg has attempted to solve the issue through the plant proteins. He has devised a method which he calls the "Serum Test" in which the protein solutions are mixed individually with the serum of an animal and added after a certain time to the protein solution from another. The formation or the absence of a precipitate and its degree gives the type of relationship between the proteins and thus of the plants. An elaborate chart has been constructed on these tests and the results show close approximation to existing facts.

Apart from the starches and the proteins the other plant substances which are peculiar only to certain groups of plants have excited interest now and then. The alkoloids, the glucosides, the tannins, the gums and the resins appear as characteristic products in certain groups of plants and on that basis a superficial working arrangement may be made with regard to those. But the tendency to generalise on these results is to be looked at with caution as we know that such substances by no means occur as constant factors but change from plant to plant according to circumstances or indeed may disappear altogether. Among the alkaloid-yielding plants, for example, cultivation has the effect of increasing the alkaloid content in some, while it decreases the content in others.

It will be noted that the chemical methods so far devised have established themselves mostly on the support of the old-fashioned methods of the botanist. They are as such of only suplementary value. Their importance, as they stand, vanished when fundamental issues such as the evolutionary trends among plants, are tackled. But the great utility of a truly natural system of classification of plants which has got the support of physiology and chemistry may revolutionise our idea of the plant families and place systematic botany on a secure foundation, though for the present the scientist looks rather to the old-fashioned ideas to

identify his plants than to the ingenious modern methods of chemist, however accurate they are professed to be by their authors.—(*Planter's Gazette, April—May 1940.*)

DEVELOPMENT OF MODERN COMPOSTING METHODS

The deliberate use of rotted organic wastes—vegetable and animal—for the purpose of growing large quantities of better crops seems to be as old as the art of agriculture itself. It is conceivable that primitive man may have simultaneously (1) noticed the superiority of natural vegetation growing in virgin forest land rich in organic matter, and (2) discovered the possibility of artifical cultivation of some of the plant species suitable for his food.

At any rate, the importance of farmyard manure to crop growth has been stressed in ancient Indian and European literature on agriculture (Russell and Richards, 1917), (King 1926) has described in detail how the Chinese peasants of old took elaborate care to collect all available wastes and convert them systematically into well-rotted composts. It is noteworthy that in every part of the world this system of returning its own waste material to land has maintained soil fertility inspite of continuous cropping through the ages. The crowded population of China is still being maintained on the produce of its soil after its agricultural use for over forty centuries. This is perhaps the most convincing proof of the perfect balance of ancient system of agriculture with their environment. It is very striking, indeed, that modern composting technique has very little to add to the basic principles underlying the Chinese method of making manure from agricultural waste.

Liebig published in 1840 his essay, 'Chemistry in its application to Agriculture and Physiology'. This marked the beginning of a period when scientific investigations and commercial enterprise concentrated on the stimulation of crop production by means of factory—made chemical manure. Subsequent work at Rothamsted and elsewhere established the manufacture of artificial fertilisers on a sound footing. Factories engaged during the war in the fixation of atomospheric nitrogen needed new markets afterwards. This further intensified the use of chemical manures. The use of bulky farm manures fell into the background. It was even asserted that this practice was not an essential feature of agriculture. A school of scientific workers, however, soon arose who maintained that a certain proportion of humus is essential to preserve in

turn the crumb structure in soils and that such a structure in turn was essential for efficient plant growth (Russell, 1913; Symposium on Soil Organic Matter, 1927).

Another group of scientists (Howard, 1937, 2) believed that the artificial stimulation of soil activities for commercial cropping was sure to upset the natural balance of soil factors and in the long run might lead to evils not yet fully realised. They maintain, therefore, that in any agricultural system adequate provision is absolutely necessary for returning all the waste products of agriculture back to the land. Howard (1937, 1) even maintains that in specialised systems such as the planting industries it may be necessary to make provision for the supply of humus to the soil by manufacturing it at extra cost from other sources to enable the soil to meet the abnormal strain resulting from highly intensive cultural practice.

Also, the large majority of the cultivators in the world still believe that the produce obtained by the use of chemical manures is not always equal in quality to that obtained by the use of ordinary farm manure.

Recent discoveries of workers on animal nutrition have apparently confirmed this belief by their findings (McCarrison 1926, 1937; Viswanath and Suryanarayana 1927; Ramiah, 1933). It has also been claimed (Howard 1937, 1) that the use of humic manures from vegetables and animal wastes impart disease resistance both to crops and the animals that feed on them. Recently, a fresh impetus was received by the investigations into the nature of soil humus and the decomposition of organic wastes to humus (Russell and Richards, 1917; Waksmanetal, 1929; Du Toit and Page, 1930, 1932; Waksman and Iyer, 1932, 1933 and others). This was accompanied by zealous attempts of other workers to discover how to make larger quantities of humic manures and how to increase the speed of the decomposition (Carbery and Finlow, 1928; Rao and Subrahmanyan 1932, 1935; Anstead 1932; Gadgil and Hegdekatti, 1937). These workers aimed at ensuring a copious supply of cheap and properly made humic manure.

Richards and Hutchinson (1921) artifically converted straw to humus by the help of ammonium sulphate. This led to the development of the patented 'Adco' process.

Fowler (1930) and Howard concentrated their efforts on the utilisation of all available organic residues for making composts of the Chinese type. Fowler stressed that it is necessary to build up an intensively active biological starter of the proper type to ensure a good start and maintain the speed thus secured throughout the course of decomposition. His

system of making activated composts is founded on this principle and is applicable equally to both farm residues and town wastes.

Howard aimed chiefly at making all types of residues into composts and thus increasing the supply of cheap humus. He saw in this means to compensate for the existing shortage of cattle dung for manure-making in India where cattle dung is badly needed for fuel purposes in the absence of a satisfactory substitute. His work in this direction culminated in the development of Howard and Wad's Indore Process (1931, 1935).

This process aims at utilising the harder residues by making them less refractory to the influence of the fermenting micro-organisms by the physical cracking of tissues or by exposing them to the corrosive environment of actively decaying material of a better composition. It lays special stress on starting the heap with a physical structure capable of maintaining adequate areation without undue loss of moisture all through the period of decay notwithstanding its composition due to the shrinkage of the rotting mass. It is maintained that a properly made heap will very soon develop within it all the required intensity of micro-biological activity by itself. All the temperature ranges and sequences of the types of micro-organisms necessary for composting will automatically appear. The process is aerobic, clean and sanitary as well as cheap and simple. The final product always maintains the proper standard of quality.

The process, therefore, spread rapidly all over the world and is applicable to a large variety of cultural systems and environments. It can convert all types of wastes quickly into well-rotted composts. This is typically illustrated by its application (1) to the disposal of habitation wastes (Jackson and Wad, 1943; Howard, 1935, 1937, 1938) (2) the composting of cane trash (Tambe and Wad 1935; Dymond, 1923, 1938) and of sisal wastes, the wastes of tea, coffee, rubber and cocoanut and oil palms (Bagot, 1936, Howard, 1938) and its modifications for making composts with rain water (Timson, 1939) and by the intermittent supply of water from canals (Jackson, Wad and Pnase, 1934).

Fowler (1934) seems to have considered partially anaerobic conditions during the later stages of decomposing heaps as having some beneficial effect.

The author of this note has observed that under the hot arid climate of the Rajputana desert the compost made with three turns had an inferior chemical composition than that produced by one turn only. It appeared that due to the different degrees in the case of fermentation of the various components of the heap the more easily decaying portions

under the stimulus of local climate reaches the stage of complete oxidation and consequent losses by the time the more refractory parts were sufficiently crumbled down. It is possible that losses of this nature may be kept down by lessening the number of turns of altering their intervals to regulate the ventilation to desired degree.

While investigating the possibilities of the hot fermenation process Rajgopal et al (1936) have conducted that in compost heaps a better conservation of carbon and nitrogen is possible when anaerobic conditions follow after a vigorous aerobic start with rise of temperature. The mechanism by which this is brought about is yet to be fully investigated.

Howard (1937) has recently evolved what he calls 'Sheet Composting'. This seems to suit wherever labour is scarce or costly. Residues of field crops are composted in situ in the field without collecting and removing them. The conditions in sheet composting are perhaps semi-aerobic. The description by Howard will illustrate an application of this principle :—

This development was worked out during the last two years on the potato areas of South Lincolnshire which have begun to suffer from shortage of Humus. After the pea-crop grown for canning has been harvested, the land is immediately drilled with beans. The sown area then covered with a layer of crushed straw from the shelling machines followed by a thin layer of farmyard manure. The Indore process then sets in on the surface of the soil. The beans grow through the fermenting mass and at the end of September are ploughed in with the layer of finished compost. Decay is rapid and by the time the fields are planted in potatoes the following spring, the resulting humus has been incorporated in the soil and is ready for nitrification. This modification is known as sheet composting—the making of humus in a thin layer all over the surface. Catch crops of beans or mustard or a crop of weeds can also be manured with humus or farmyard manure before ploughing, in the autumn when sheet composting again takes place. The turf of old pastures or old leas can be converted into humus in a similar fashion. The Indore process has in this way been applied with success to no less than three important practical problems, green manuring, the effective utilisation of weeds and stubble and better utilisation of the old turf of grass land.

Similar attempts at simplification are being made by applying waste organic matter direct to the soil with inorganic reinforcements. (Eden, 1935-1936) The present system of burying tea prunnings and loppings of

shade trees along with the chemical manures may also be considered a similar operation.

It appears to the author that perhaps the most economic and convenient method of returning waste material to land will be preliminary aerobic decomposition to a suitable stage followed by direct application to the field, a few weeks before sowing time, before preparatory cultivation begins. There seems to be some scope for such a method as it involves the least deviation from current routine as well as the minimum of labour and care. (*Planters Gazette, April—May 1940.*)

B 1 FOR BREAD

More nourishment from the loaf.—The husk of a grain of wheat contains the vital element—known as vitamin B 1. A large part of the world's population is said to be suffering from a deficiency of this vitamin. A simple way to make good the deficiency would be to eat wholemeal bread, a course long advocated by dieticians. But for most people that solution of the problem is too simple. They prefer to eat the emasculated white loaf and give pigs the benefit of the vitamin B 1.

The scientist has now produced another solution, hailed as the greatest dietetic discovery of modern times. After years of research, at great expense, he has succeeded in manufacturing vitamin B 1. in the laboratory. In England it is proposed to add this synthetic vitamin to all white flour. Only a tiny amount is needed: a quarter of a milligram to every 11 ounces of bread. One ounce will supply a man with his needs for 75 years. The annual cost of the "injection", at the moment is estimated at £ 1,50,000. to be borne by a Government subsidy.

By this means the public will continue to enjoy white bread, fortified with synthetic vitamin; pigs will continue to enjoy the natural product; and food "faddists" will continue to enjoy wholemeal bread, which dieticians say is more nourishing than white bread, even when that is scientifically improved.—(*Hindu*).

COTTON POSTERS

As a result of the paper shortage, advertising posters in Britain may be made of cotton. According to the Manchester firm which is sponsoring the scheme, the cloth developed for the purpose has a special gloss surface suitable for printing.

Cotton posters, it is contended, will stand up to the weather better than paper and because of their greater durability will be more economical in the long run, though the initial cost is slightly higher,

Other uses may be found for cotton fabric. Liverpool Cotton Corporation have adopted it for notepaper.—*(Hiudu).*

STARCHLESS POTATO

In the belief that potatoes are fattening, many people with a tendency to stoutness eat sparingly or not at all of this vegetable. In the future they may be able to eat potatoes to their heart's content without risk of adding to their too solid flesh. A horticulturist at Yonkers, New York, has produced in his greenhouse a starchless potato.

Called a "topato", the new plant is the result of the successful grafting of potatoes and tomatoes, the fattening tendency of the one being balanced by the slimming quality of the other. The "topatoes" grow from the roots of the plant in the manner of ordinary potatoes; the upper branches of the plant yield tomatoes.

No soil is used in the cultivation of these new plants. They are grown in gravel and feed on seven chemicals, including magnesium sulphate, applied twice daily.—*(Hindu).*

"THE MAGIC BEAN"—(SOYA BEAN).

Provides everything—food to explosives.—The Nazi claim that the use of the soya bean will give them sufficient strength even to withstand the blockade is exaggerated, but there is no doubt that any nation which can obtain large supplies of this amazing plant has a raw material unique in the variety of products that can be obtained from it. Normally Germany imported more than 1,000,000 tons of these beans, but some of this supply must have been cut off, and large as it is, it could do more than supplement other raw materials.

It is easier to give a list of products that cannot be made from the soya bean than one of the uses to which it has been put, but here is a summary of the chief uses. First for human food, it can be ground and mixed with flour, when the high protein content gives the resulting loaf the dietic value of bread and meat. Moreover, the loaf keeps about two weeks before becoming stale. A milk can be produced from the bean which is used like ordinary milk, and can be turned into cheese. Oil obtained from the bean can be used for cooking or turned into margarine. A coffee substitute has been prepared from it.

Then as a feeding stuff for animals, the bean is exceedingly valuable producing a rich cake for cattle. Even the stripped plants are valuable as fertiliser when turned into the ground.

As a raw material for manufacture soya bean is used for making glycerine, soaps, lubricants, varnishes, paints, plastics and explosives. From this limited list it will be seen that the soya fully lives up to the description "magic bean."

The supplies which Germany has been receiving came from Manchuria, the native home of the bean, the United States and probably to a lesser degree from the Balkans. The bean has been successfully grown in most countries, including Britain, but it is only in certain climates that it is economically the most profitable crop. Germany's home production is believed to be negligible, as plant experts have been quite unable to get reasonable crops.

In the U. S. A.—In the United States to which the bean was taken from Manchuria, it has been enthusiastically exploited by Mr. Henry Ford who claimed that it could be made to yield everything required for making a motor-car except the metal. He put down 12,000 acres and claimed that four times this area would be sufficient to supply enough lubricating oil, paint, varnish, etc., for 1,000,000 cars a year, in addition to plastics for dash-boards, controls, etc. The total area under cultivation in the U.S.A. has risen from 500,000 acres in 1917 to 5,000,000 acres to-day.

In Britain under his inspiration special seed has been produced and planted. Twenty acres were cultivated in 1934 and the seed from them distributed to farmers. The great difficulty is that even the seed specially bred to meet English conditions is apt to fail in a poor summer and the variable climate therefore makes it an unreliable crop.

The soya bean has a very characteristic smell and taste and although this seems attractive to Eastern palates, it is decidedly unattractive to many Western people—and even animals. When attempts were made to include the bean in the food of Welsh pit ponies, they refused to touch the meal even when the bean was most cunningly mixed with other substances.

For the manufacture of margarine, glycerine, etc., the oil is deodorised. Some years ago an Italian scientist claimed that he had devised a method of removing the taste and smell and that the flour could be used for cakes, baby-food, etc. In Germany, of course, no account is taken of tastes—if Hitler says the Germans must like soya, they like it.

The extraordinary health value of the bean which led Dr. McCollum of the John Hopkins Institute in the U. S. A. to claim that it would reduce the mortality rate by 20 percent in a year, has led many,

enthusiasts to persevere and they declare that the taste can be acquired. No doubt if the bean was part of our diet from infancy, we should find the taste pleasant.

The bean grows on a hairy, leafy bush, and the beans vary in size, shape and colour, the most prized being those of a golden yellow colour. *(Hindu).*

College and Hostel News

The dreary summer lapsed and we came to the College with bubbling enthusiasm on the 14th June. Our revered Principal in his inaugural address stressed the importance of punctuality and discipline as they form the very back-bone of a successful career not only in the College but in our future life as well. We do hope that all of us will cherish the precious advice of our worthy Principal to make our career brilliant.

We feel great pleasure to congratulate the following of our friends on their unique success in the Varsity Examinations of 1940.

(1) Mr. G. R. Shirpurkar—1st Division in the B. Sc. (Agr). Examination and winner of Sir Arthur Blennerhasett Memorial Medal and Chakradeo Memorial Medal.

(2) Mr. J. N. Hota—1st Division in the Intermediate Examination in Science (Agriculture) and awarded the Sir Arthur Blennerhasett Memorial Medal.

Messrs. J. P. Shrivastava, B. B. Misro, S. R. Chopde, S. K. Palnetkar, P. M. Ingley, A. M. Deshpande and R. G. Kelkar for having passed in the first Division in the Intermediate Examination in Science (Agriculture).

This year the second year batch has kept a record in the history of the College by placing 8 of its students in 1st Division. It is really good on the part of the students and staff—without whose co-operation this would not have been possible. We hope that all of the above friends will maintain their standards in the Final Examination and thus bring honour to the Almamater.

We are glad to note that the traditional regional spirit has given place to harmonious co-operation of all students in every sphere of College

activity. This year's election may prove to be a landmark in the history of the College. All office-bearers excepting the General Secretary were elected unanimously and unopposed.

The elections no doubt infuse admittable energy in the students and offer a better chance to step forward in the World's best sphere. We congratulate the following persons elected and hope that they will realize their responsibility and discharge their duties in the best manner possible. They are sure to fulfil the hopes for which they stand and make their career glorious.

General Secretary for College	...	Mr. P. M. Ingley.
" " Sports	...	" S. K. Palnetkar.
Foot ball Captain	...	" P. T. Rajkondawar.
Hockey Captain	...	" Ajit Singh.
Volley ball Captain	...	" L. Pande.
Tennis Secretary	...	" B. B. Banerji.
Librarian	...	" J. N. Hota. (Nominated)

It is our good fortune to offer our heartfelt felicitations to some of our bright ex-students who are bringing honour to the Almamater. Mr. P. C. Verma, ex-General Secretary and a distinguished student of our college has been selected to the King's Emergency War Commission as an Officer in the Indian Army. We wish him every success in his future life. Mr. K. R. Sahasrabudhe has been awarded the King Edward Memorial Scholarship for further studies on wheat under Dr. R. J. Kalamkar.

Lack of accommodation has compelled us to postpone the elections of office bearers for the Self-help Debating Society. Last year's Secretary, Mr. R. N. Bhargava, has been made the Vice-President and will continue to work as the Secretary and Vice-President for the time being.

Our newly established Quiet-Hour Association though in its infancy is progressing well under the guidance of Mr. S. K. Misra, an enthusiastic and righteous Professor of our college. This year Pandit Vidyanandji, B.A., a veteran Vedic Scholar and Head Master, D. A. V. High School, was present for the first meeting of this Association. Panditji explicitly explained " The teachings of Bhagavat Gita."

Our college building is still under repairs, but the right wing is being utilized for class rooms and now there is no more need of going to other institutions. Our thanks are due to the authorities of the College of Science, who were kind enough to give us rooms in their College upto the 6th July. The College office has occupied some of the

rooms of the hostel and the Final year students are put to some inconvenience. We hope that this inconvenience to the Final year students will soon be removed when the office is shifted to its original place. It is heard that the portion occupied by the Director's office will be available for the College and an additional chemistry laboratory will be provided in this building for Intermediate students.

As usual our foot-ball and hockey teams have started practising with great enthusiasm though the continuous rains have proved to be a great menace to them. We wish the players success in keeping their merit in the University tournaments. This year we have decided to start practising Cricket.

It has been decidid that the Janmastami, Ganesh Utsava and Social Gathering will be performed under the guidance of a Committee in which the President is Mr. E. A. H. Churchill,

Vice-President ... Dr. V. G. Vaidya,
Secretary ... Mr. P. M. Ingley,
Treasurer ... Mr. S. K. Misra,

with some representatives from students and staff. We hope that all these functions will be performed with full co-operation of the students and staff. The hostellers seem to be busy in preparing for the programmes to be carried out in the festivals. As usual it is decided to stage one Marathi Drama 'Ghara Bahir' by Prof. Atre and one Hindi Drama 'Neech' at the time of our festivals and we wish the actors success.

This year about 50 students were admitted to the first year. The number is decidedly more than that of last year and it explicitly proves that, agricultural education is in great demand. Still many of the applicants had to be disappointed due to lack of accommodation.

The general health of the hostel is quite good. All the hostellers have been inoculated against cholera and every precaution is being taken wherever necessary, e. g. boiling of drinking water, keeping the mess surroundings clean, etc. The College Hostel Library and College Co-operative Stores have as usual started working. It will be a great help if the Hostel Library is furnished with a few more publications.

To the Farmer

In merry Nature of the month of March,
When melodiously the cuckoo chants ;
You in the solitude, O farmer !
What art thou whispering to the plants ?

Art thou expressing a heart-felt feeling
Of thy woe and thy grief ?
Alas ! the cool sighs of thy heart
Are ne'er followed by relief.

Or, thou art embracing the plants of the field,
Whom thou hast brought-up like children ;
Sacrificing thy life for their sake.
In the rains and the hottest sun !

By thy blessings, O farmer !
They have flourish'd with prosperous growth ;
The real benefactor in the world thou art,
Of the rich and the poor alike.

M. P. SHRIVASTAVA.

Second year.

TENDER NOTICE

Sale of Agriculture Machineries and Implements

GWALIOR STATE

Sealed tenders are invited for the purchase in whole or in part of a large stock of new and second-hand Agricultural Machineries and Implements *viz* Tractors, Ploughs, Harrows, Thrashers, Disintegrators, Crushers, Mowers, Winnowers, Hay Rakes, Cultivators, Planet Juniors, Oil Engines, etc., etc, with accessories and parts belonging to the Agricultural Department, Gwalior State and are open to inspection at the Implement Stores, Central Farm, Gwalior.

Printed list of stock can be had on application to the Boring Engineer, Gwalior Government, Gwalior.

Tenders are required to be submitted to the undersigned in prescribed form (which embodies also the terms and conditions of sale) and are to be obtained from the Boring Engineer on payment of Rs. 5/- per copy.

Tenders must reach the Office of the undersigned during office hours up to 4 p. m. on or before 30th November 1940 after which no tenders will be entertained.

E. J. HOPE,

Manager, Gwalior Light Railway,

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Editorial Notes

We have very great pleasure in congratulating Mr. B. Subba Rao, L. Ag., (Hons), on his promotion as Extra Assistant Director of Agriculture. Mr. Subba Rao has to his credit a long and meritorious service in this college as Lecturer in Agriculture. In this capacity he has distinguished himself in every manner. In the social life of the College he has made an indelible mark of himself by his talents in music and sports. His promotion is welcomed as a fitting recognition of the valuable services rendered by him in this College.

Mr. Subba Rao was closely associated with this Magazine as its Editor for the last four years. During this period, he spared no pains in enriching it by securing valuable contributions. The magazine committee extends its special thanks to him for the lively interest taken by him in making this magazine a success, and wishes him every success in his new appointment.

INDIAN AGRICULTURE DURING THE FIRST YEAR OF WAR
(Sept. 1939 to Oct. 1940)

THE COURSE OF COMMODITY PRICES

The course of commodity prices during the first year of war makes an interesting study. With the out-break of the war the price levels which remained low during the depression years received a sudden stimulus. The Calcutta index number of wholesale prices in India showed a rise by 14 per cent in September

1939 as compared with the earlier month. The rise in retail prices was remarkable. It may be attributable mainly to the profiteering motive of the merchant community in India. Such an attempt at indiscriminate "putting up" of the prices was immediately checked by the action of the Provincial Governments. This rise being purely an artificial one could not justify itself any longer and a strong reaction immediately followed. This brought down the prices to a level where they could be maintained by the economic forces ruling the market in the novel circumstances of the war. Contrary to the imagination, the declaration of the war did not mean any considerable dislocation of the normal trade activities. As soon as these imaginary fears proved to be futile, by the experience of the days that followed, a gradual lull commenced, which existed till the end of October 1939. The two months that followed viz. November and December are the most notable, as the prices then reached at their highest level. Feverish speculation led to this hectic rise. Prices of cotton and jute were almost doubled up at this time. At the close of the month of December 1939 the general index of prices rose to the level of 137.

This rise was maintained somehow during the first month of the new year, but could not be continued any further. In fact the opposite tendency now grew stronger. All the stocks which were held so far were gradually released and nervous selling commenced. This process was accentuated during the following months due to the anxiety created by the events on the European continent. Terrific selling pressure gradually brought down the commodity prices index from 117 in May to 114 in July. By the close of the year this remained only 11 points higher than the pre-war level.

WAR TIME LOSSES OF TRADE, BUT LARGER EXPORTS TO EMPIRE COUNTRIES

With the extension of war in Europe the Indian export trade structure of agricultural commodities has been subjected to a

number of changes. India has severed her trading connections with U. S. S. R., Norway, Germany, Belgium, Austria, Czechoslovakia, Italy, Italian East Africa etc. As a result of this the loss to the Indian trade is estimated to be nearly 22% in value of the average total Indian exports. But it is gratifying to note that this loss has been made good by the increased off-take of the 15 Empire countries the largest share being that of Great Britain. During this period exports of merchandise to foreign countries shot up by Rs. 40/- crores in value, as compared to the preceeding twelve months. Out of this trade the Empire countries may be held responsible for Rs. 36/- crores, the share of United Kingdom being Rs. 22/- crores. Of the non Empire countries U. S. A. which is now our third principal buyer increased her trade by nearly Rs. 13/- crores in value, while South America has made a record increase by about Rs. 20/- crores. Our exports to Egypt show an increase by over 1½ crores of Rupees while exports to Switzerland, have been multiplied seven times. The share of Java, Sumatra and Borneo is now doubled up, while Turkey, Arabia, Iraq, Thailand, Portuguese East Africa and West Indies have now received larger shipments from India.

THE PROBLEM OF UNEXPORTED SURPLUS

It is now feared that if the present war turns out to be long drawn affair, we may not be able to maintain the outflow of our primary commodities to the other countries. A novel problem of unexported surplus resulting in unremunerative prices may arise and we may be required to find out ways and means for the disposal of the surplus produce for preventing the depression in prices. The commodities that will require special consideration are cotton, jute; oilseeds and wheat. The case of cotton may be alarming if our relations with Japan are strained. The problem of jute may find a partial solution by the fixation of the minimum prices and the proposal to purchase the surplus stock by the Government. Of the oilseeds, linseed and groundnut have presently improved,

thanks to the agreement reached between the Government of India and the British Ministry of food.

However efforts done so far may hardly prove equal to the task, in view of the eventualities we should be prepared to face. A definite plan will have to be worked out for the same. It may be suggested that curtailment of the area under these crops in the following seasons and the growing of alternative crops may be followed to the exent to which it is possible.

NEW USES OF AGRICULTURAL COMMODITIES

Relief of a permanent nature would be available by the utilization of these primary commodities by local manufacturers. This will also save considerably the uneconomic long-haul exchange that we have been following so far. The benefit of this method will be of supreme importance. Government efforts in this direction have so far progressed considerably. The various industrial research institutions in India which are now co-ordinated under the aegis of the Board of Scientific and Industrial Research have made promising experiments in this connection. The possibilities envisaged by them for the utilization of agricultural commodities for industrial uses may prove to be a welcome relief. Research has been carried on the utilization of cotton for some new purposes such as, road making, cotton belting, pneumatic tyres, sugar bags, surgical materials or to replace the imported cellulor cloth for undergarment and the substitution of cotton yarn for rayon, cellulose etc. Special effort is being made for utilisation of mollases for preparing organic chemicals and acids at the instance of a special committee appointed by the Board. The U. P. Government have already succeeded in the manufacture of power alcohol from molasses on an industrial scale. Very soon this will be placed in the market. It's use for building purposes may be introduced as this increases the tensile strength of lime surkhi and lime cement mortar and the setting period is also reduced. The

utilization of our oilseeds for various purposes such as, preparation of synthetic chemicals pure and commercial stearic and other acids, lubrication, water proofing and in the manufacture of paint and varnishes will be of great benefit.

IN QUEST OF ALTERNATE MARKETS

The value of commercial agreements is immense at this juncture Opportunity may be taken at this time to negotiate with various countries and establish trade relationships. The Empire countries east of Suez have now a special opportunity to develop their trade with each other in common interest. The recent session of the Eastern Group Conference held in India has given a great fillip to this idea. Talks outside the conference have great exploratory value. The recent visit of the Gregory-Meek Mission to America has also shown what special effort is needed to advance the sales of Indian products in that country. Negotiations with Burma, Ceylon, Africa are already making a headway. The appointment of the trade Commissioners in Australia, and Malaya may be welcomed.

Thus an all sided effort, the beginnings of which are already made will be required to meet the exigencies of the situation and to derive the greatest good from "The things evil," which we are called on to face to-day.

Original Articles

MANURES AND FERTILISERS IN RELATION TO VARIOUS CROPS

By Rao Bahadur D. V. Bal, M. Sc. (Agr.) (Hons.); A. I. C., F. C. S. (Lond.)

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In order to understand clearly the various aspects of manuring it is necessary to deal with briefly some of the important characteristics of soils. The soil is not a static mass made up only of dead and inert material but on the contrary it is in a powerful dynamic condition in which various chemical, physical and biological forces are continually operating to a greater or less extent according to the seasonal fluctuations.

The fact that the growth of plants under natural conditions depends on the living agency of the soil can be easily seen from the striking difference in plant growth between plants growing in pots containing sterilised and unsterilised or normal soil.

Physical properties of the soil:—The physical condition of the soil depends upon the presence of right proportions of various mechanical constituents like clay, silt and sand in the soil in relation to the climatic conditions, and in addition an adequate proportion of organic matter and lime. An adequate amount of organic matter in the soil is absolutely essential in order to bring the soil into the required state of tilth and for the better utilisation by plants of the fertilising constituents that may be present in the soil or which may be added in the form of artificials.

The mode of arrangement of the soil particles—which are coated with a jelly-like or colloidal material—their size and shape are responsible for the soil tilth, and on which depend the moisture and air relationships of the soil in relation to plant growth. The pore space in a soil may thus vary from 26 to 47% depending upon the arrangement of soil particles. Soil aeration is essential to fertility and various cultivation processes are adopted in order to facilitate the renewal of the soil air, and to increase its supply in the soil.

Chemical composition:—A large proportion of the soil material varying from 60 to 90% is inert being insoluble in even strong hydrochloric acid and does not therefore represent nutrients of any immediate value to the plants. The remaining portion represents moisture, and organic and inorganic plant nutrients which are present in either soluble or easily available form. The soil contains a large number of organic and inorganic constituents but only a few of these can be considered as indispensable. They are taken up by plants either as such or after they have undergone certain transformations in the soil. Some of these are required in large quantities by the plants and others though required in very small quantities are quite essential.

The organic constituents of the soil can be broadly classified as nitrogenous, and non-nitrogenous or carbonaceous. The former after undergoing adequate transformations in the soil supply nitrogen to the plants, and the latter help the beneficial soil micro-organic activity and supply the bulk of the soil organic matter which is so very essential for maintaining the tilth of the soil.

Out of the inorganic constituents present in the soil phosphorous, potash, and lime are required by plants in appreciably large quantities,

Lime is also essential for maintaining the tilth, reaction and beneficial biological actions of the soil. Mechanical and chemical composition of some typical soils of the Province can be seen from the results of analysis given in the following tables :—

TABLE I

Mechanical composition of some C. P. soils. (Samples taken to a depth of 8″ to 9″).

Percentages in air-dry soils passed through 1 or 2 mm. sieve.

	$CaCO_3$	Coarse sand	Fine sand	Silt	Clay
Black cotton soil ...	6.32	2.62	8.53	34.93	36.92
Mariar soil ...	0.92	2.40	14.39	31.45	43.55
Kanhar soil ...	0.22	0.60	4.04	32.63	53.00
Dorsa soil ...	0.33	2.89	3.51	42.50	41.99
Matasi soil ...	0.08	13.78	29.08	29.90	18.30
Sehar soil ...	0.05	8.44	25.26	42.78	18.43

TABLE II

Average chemical composition of some C. P. soils.
(Samples taken to a depth of 8″ to 9″).

	% Total		% Available		% Total	M. E. %		% N
	P_2O_5	K_2O	P_2O_5	K_2O	Calcium	Total Exchangeable bases	Exchangeable calcium	
Black cotton soil	0.052	0.33	0.005	0.007	2.00 5.0	65.9	51.60	0.05
Mariar soil	0.063	0.57	0.005	0.020	1.50 ...	46.5	42.95	0.04
Kanhar soil	0.070	...	0.002	...	0.90 ...	30.0	25.00	0.05
Dorsa soil	0.050	...	0.002	...	1.20 ...	30.0	25.00	0.05
Matasi soil	0.040	...	0.005	...	0.36 ...	15.0	11.00	0.04
Sihar soil	0.030	...	0.003	...	0.98 ...	...	26.00	0.05

Fertilising constituents present in the soil are not all completely available to the growing plants. Those which can be dissolved in either water or weak acidic solutions e. g., the soil solution charged with carbondioxide are classified as available constituents and those which are incapable of being dissolved in this way are called unavailable or dormant. The dormant plant food in the soil is however being slowly converted into available material by the various physical, chemical and biological agencies of the soil.

GENERAL REQUIREMENTS OF CROPS

Plants require for their growth substances like carbondioxide, water, oxygen, and suitable compounds of nitrogen, phosphorous, potash, sulphur, calcium and magnesium. Of these carbonioxide is obtained from the atmosphere and some like calcium and sulphur, though taken in large quantities are ordinarily present in sufficient quantities in average arable soils. Special cases are however met with where the lime status of the soil is required to be adequately maintained by artificial methods. Nitrogen, potassium and phosphorous compounds which are also required by the plants in large quantities are however generally present in inadequate quantities in Indian soils and are therefore required to be supplied to the soils in order to obtain better crop yields. Before considering the question of supply of these three fertilising constituents to the soil, we shall first consider briefly the important functions performed by these constituents in the growth of plants.

(a) Nitrogen performs the following functions in the growth of plants:—

(1) It is an essential constituent of all plant proteins.

(2) It is connected with the production of well-developed leaf system which is important from the point of carbon assimilation.

(3) It stimulates cell reproduction to a remarkable extent, and thereby favours the vegetative phase of plant growth.

(4) It contributes to the formation of chlorophyll and is an essential constituent of this complex.

(b) Phosphorus performs the following functions in the growth of plants:—

(1) It is necessary for the formation of various plant compounds.

(2) In the early stages of plant growth it promotes root formation and in the later stages it hastens ripening. Cereals suffering from phosphate starvation have a stunted root system, and a decreased number of tillers bearing seed.

(c) Potassium performs the following functions in the growth of plants :—

(1) It increases the efficiency of carbon assimilation of plants.

(2) It is essential for the synthesis of protein and cell division in the growing plant.

(3) It facilitates the supply of water to the plant.

(4) It counteracts the tendency to soft growth due to excess of nitrogen, and thus makes the plants more resistant to fungus diseases.

MANURES AND MANURING

Manures may be applied to the soil either to replace the plant food abstracted from it by the crop or to supply plant food with a view to increasing the productiveness of the soil beyond its natural capacity. Manures may be classified into two main groups e. g. (1) general manures and (2) special manures. General manures such as Farm Yard Manure and various other plant and animal residues contain all the necessary constituents of plant food in small quantities. In addition to the function of supplying plant nutrients in small quantities they perform the important function of maintaining the tilth and general fertility of the soil on account of their high organic matter content and the comparatively resistant nature of their fertilising constituents. General manures are therefore the safest to employ in practice, particularly when the manurial requirements of the soil are not well known, because by their use, although the soil may be receiving additions of certain constituents which it may not require, such additions do no harm and a better crop results from the increased supply of the other constituents in which the soil may be lacking.

Special manures contain very high proportions of only one or two fertilising constituents, and cannot therefore supply requirements of plants. They are either inorganic salts like ammonium sulphate, potassium sulphate etc. or organic substances like oilcake, dried blood, flesh manure etc.

BULKY OR GENERAL MANURES

In view of the particular importance of organic matter in the soil we shall first briefly consider the question of bulky manures and some easy methods which can be employed to maintain or increase the organic matter content of the soil.

Farm yard manure.—One of the usual methods known to the cultivator and practised by him for many years is to apply Farm Yard Manure to

the soil. Ordinarily for crops like cotton, wheat, and rice a basal dressing of about 2½ to 4 tons of Farm Yard Manure should be given per acre annually or at least once in two years. A very large quantity of the available cow-dung is however normally used as fuel by the cultivators and this practice is bound to continue till an alternative source of fuel becomes available. The loss of natural Farm Yard Manure thus sustained can be made good to some extent by adding organic matter to the soil according to the methods described below :—

(1) **Preparation of artificial Farm Yard Manure.**—Various waste materials like cotton stalks, pigeon-pea (tur) stalks, weeds, fallen leaves, *Sann*-hemp and ambadi stalks, old thatching material etc. usually available to the cultivators can be converted into useful and quickly available manure which compares favourably with the natural Farm Yard Manure obtained from cattle dung. Organic matter added to the soil can produce beneficial effects only when it does not differ widely in composition (e. g. a specific C/N ratio) from the natural soil organic matter known as humus, and a properly prepared cattle-dung manure, is to a large extent similar to soil organic matter. The object of the method of preparation of artificial Farm Yard Manure is therefore to convert the various raw waste materials, as quickly and economically as possible into a product which is more or less similar in properties to ordinary cattle-dung manure, and the following are some of the important factors involved in this process :—

(1) Mechanical pulverisation of the raw material as far as possible.

(2) Adequate aeration and moisture.

(3) Addition of available nitrogen in the form of ammonium salts or urine.

(4) Introduction of suitable organisms with a view to accelerating the process of decomposition.

Results of analysis of samples of artificial Farm Yard Manure prepared from various raw materials given below will clearly show that this manure is as good as ordinary cattle manure ;—

Description of the sample.	Percent moisture in the original sample.	Percent organic matter in dry matter.	Percent nitrogen in dry matter.	Percent nitrogen in organic matter.
Artificial F.Y.M. from cotton stalks	11.77	51.60	1.74	3.38
Artificial F.Y.M. from rice straw	45.60	23.60	1.09	4.63
Artificial F.Y.M. from leaves and weeds	51.66	33.60	1.22	3.67
Ordinary F.Y.M. from cattle-dung	26.50	34.70	1.24	3.57

(2) Another important source of organic matter is human excreta or night soil which, if efficiently utilised as manure, would prove of immense value in enriching the soil. The importance of this manure has long been recognised, as is evident from the high prices offered for lands situated near the village sites which get highly fertilised and give higher crop yields than those obtained from ordinary fields away from the village. Although the value of night soil is recognised, its use as manure has been entirely neglected partly on account of the distasteful task of applying it to the land and partly due to caste prejudice and conservatism. We should therefore try our best to induce the cultivators, to cast off their prejudices and conservatism against the handling of this manure wherever it is available in an odourless form e. g. near municipal towns and other places where sanitation committees function. We should also induce them to adopt simple and inexpensive method like the 'earth-closet' system or the 'movable latrine' system, in rural areas, and thus save the country from this colossal loss of natural fertility, which, in no small measure, is responsible for the continuous deterioration of our soils and the low crop yields as at present obtained.

(3) In addition to the above two sources of organic matter, there is another important source, namely, green manuring. Ordinarily green manuring means turning under undecomposed green plant material either grown in-situ or brought from the adjoining fields. Green manuring crop can be sown as a main crop, companion crop or a catch crop (i. e. a crop worked in after a main crop has been taken off or between two main crops). Out of these green manure as a main crop cannot usually be justified as it is too expensive and usually the cultivator can scarcely afford to cultivate his land without expecting any kind of crop

return during the season. Green manures should therefore be commonly used as companion or catch crops.

Choice of the green manure crop.—Whenever a green manure crop is to be used, preference should be given to a legume if it is available, because such a crop due to its capacity to fix atmospheric nitrogen through symbiotic bacteria associated with its root nodules, will add materially to the nitrogen content of the soil. In this connection it is necessary to emphasise that if the green leafy material and the stems are removed from the field, and if only roots together with their nodules are returned to the soil we do not add much nitrogen to the soil as is generally believed by some people. The atmospheric nitrogen fixed by the organisms in the nodules is translocated continuously to the leaves and in exchange soluble carbo-hydrates from the leaves which serve as a source of energy to the bacteria are translocated to the nodules on the roots. Up to a certain stage of growth of the plants, and depending upon other factors associated with soil moisture etc. new nodules are formed on the roots and the old ones fall off. A green crop of *Sann*-hemp 6 weeks old contains about 74% moisture and 0.3% nitrogen.

Approximate percentage distribution of the total nitrogen contained in various leguminous green manuring plants is shown below:—

Leaves	...	...	...	65%
Stems	...	...	...	25%
Roots	...	...	...	10%

Depending upon climatic conditions the following average yields of green crop can be expected from certain legumes in the important crop tracts of the Province:—

Name of crop.	Quantities of green crop per acre.	
	Rice tract.	Wheat and cotton tract.
	lbs. lbs.	lbs. lbs.
Sann ...	4,000 to 10,000	15,000 to 22,000
Sawri or Dainchya ...	3,000 to 8,000	10,000 to 20,000
Cowpea ...	3,000 to 7,000	12,000 to 16,000

When there is a choice between two or more legumes, one which is more leafy, less woody, quick growing, and deep rooted should be selected as the rapidity of decomposition of plant material depends on the age and

condition of the material turned under; young and highly nitrogenous material decays more rapidly than that having a high fibre content.

While the maintenance of the nitrogen supply is an important object of green manuring, there are other benefits of no small importance e. g. improvement of soil tilth, increased solubility of soil minerals due to the acceleration of the rate of CO_2 production in the soil, suppression of weeds as a result of the shade effect produced by the thick crop, and keeping the ground cool and thus checking to some extent, rapid evaporation of soil moisture.

Seed inoculation.—Inoculation of the legume seeds with appropriate bacteria is necessary under certain conditions e. g. (1) on lands newly cleared for cultivation, (2) when a new legume is being introduced (3) when the nodule organisms though originally present in the soil have either become extinct or lost their efficiency owing to unsuitable conditions of cultivation.

Time and depth of ploughing.—The time of ploughing the green manure crop will depend on the various local conditions and the purpose with which the green manuring crop is sown. If a subsequent rabi crop is to be grown, there must be sufficient moisture to decompose the green crop and to supply the following crop. This is particularly important where irrigation is not available. Experiments carried out in our Province have shown that in areas where there are no irrigation facilities and the annual rainfall is less than 35", green manuring for a rabi crop is out of question. In areas with a higher rainfall which is fairly well distributed, green manuring for wheat would be successful, provided that at least 12 to 16 inches of rain is received after inversion of the green crop in the month of August and before wheat is sown in the following winter.

Even where irrigation is available the time of ploughing is important because of the effects of the decomposition of green manure on the germination and subsequent stand of the following crop e. g. in the case of paddy, if the green manure is applied either one or preferably two weeks before the date of transplantation of the seedlings, the yield obtained is considerably higher than that obtained when the green manure is incorporated with the soil at the time of transplantation. For the reasons given above the object of getting as large a quantity of the green crop should not therefore be the only consideration.

The depth of ploughing appears to be of minor importance as far as decay of the green-manure is concerned. Where high temperatures and excessive aeration of the surface of cultivated soil exist, deep ploughing

is strongly advised. In sandy soils the green-manure should therefore be turned under more deeply than in heavy soils.

Fertilising the green-manure crop.—The amount of atmospheric nitrogen synthesised by the leguminous green-manuring crops will depend to a certain extent on how abundant is the supply of minerals available to them. In this connection it is necessary to point out that phosphates and potash are capable of being fixed in the soil, and if they are not fully absorbed by the green-manure crop, they will not therefore be lost by leaching but will be utilised by the subsequent crop. Depending upon the deficiency of P_2O_5 or K_2O in the soil 2 to 4 maunds of superphosphate or bonemeal and 100 to 200 lbs. of potassium sulphate either singly or in combination may be found to benefit the green manure crop.

The desirability or otherwise of adopting the practice of green-manuring, like any other farm practice, can however be ultimately decided by judging the returns on an economic basis. The account of the practice of green-manuring given above can be briefly summarised as follows :—

(1) Green-manuring is an important agricultural practice in various parts of the world.

(2) Results of various experiments show that under favourable conditions green-manuring causes large increases in the crops that follow it.

(3) Satisfactory results from green-manuring must always depend upon the successful production of two crops i. e. (a) the crop for green manure, (b) the crop to benefit from the green-manure.

(4) In areas where irrigation is not available, adequate rainfall which would decompose the green manure, and yet leave enough moisture in the soil for the use of the succeeding crop, is absolutely necessary.

(5) When a new area is being brought under cultivation or when an entirely foreign leguminous crop is being introduced in a particular area, the question of inoculation of the seed with a view to introducing the requisite nodule organisms in the soil should be borne in mind.

SPECIAL MANURES OR ARTIFICIAL FERTILISERS

Having dealt with the question of supply of organic matter to the soil and its conservation at some length, we shall briefly consider the question of supply of the three important nutrients, viz., nitrogen, phosphorus and potash which have been referred to in the beginning. Out of these three, nitrogen appears to be pre-eminently the limiting constituent in the soil and applications of nitrogenous fertilisers, therefore, often give spectacular results, and

are for this reason somewhat more popular with the cultivators than the phosphatic or potassic fertilisers. In so far as the ordinary field crops except rice are concerned, either sodium nitrate or ammonium sulphate, depending upon climatic conditions, can be usefully employed. Ammonium sulphate, though more safe than sodium nitrate as it is not leached out of the soil by washing, does not always give the best results. During the monsoon, for example, it has been observed several times that after long continued rainfall, waterlogging takes place and the natural process of nitrification in the soil is checked and the cotton plants become stunted and yellow due to deficiency of available nitrogen. Under such conditions it has been found that the plants regain their lost vitality very quickly, become green and throw out new growth after a top-dressing of nitrate of soda.

Amonium sulphate is not absorbed as such by a majority of crop plants as its nitrogen is required to be converted into nitrate with the help of soil bacteria. Under conditions of adequate moisture in the soil ammonium sulphate will therefore be more advantageous than sodium nitrate for the following two reasons :—

(1) As already mentioned above, nitrogen from this fertiliser is held very firmly by the soil and is not therefore leached out of the soil.

(2) As the nitrogen is gradually converted into the available form of nitrate, a steady supply of this constituent is available in required quantities for a long time during the growth period of the crop.

Phosphatic fertilisers do not appear to give any spectacular results with ordinary crops and although their use may improve the quality of the produce and vigour and disease-resisting capacity of the plants, the advantage thus obtained may not compensate, in every case, for the extra cost of the fertiliser employed. Field experiments conducted with paddy on some of the farms in the Central Provinces have however shown that the use of superphosphate or bonemeal along with green manuring is more paying than green manuring alone.

Average soils do not appear to be deficient in potash and hence potassic fertilisers are not commonly used in ordinary farming. Potassic fertilisers on light soils with leguminous crops like groundnut have however been found to be very beneficial. Experiments conducted at Akola (Youngman and Janoria, 1927) with groundnut grown on local black cotton soil have proved that the most profitable fertiliser for this crop is sulphate of potash at the rate of 70 lbs. per acre.

Potassic fertilisers have also been found to be very useful for sugar-cane. They are reported to improve the quality of the juice by increasing the percentage of cane-sugar and reducing the percentage of invert sugar.

Phosphatic and potassic fertilisers should be applied to the land either sometime before or at the time of sowing the crop.

FERTILISERS IN RELATION TO GARDEN CROPS

Vegetable crops:—The use of artificial fertilisers has often been found to be remarkably profitable with various garden crops. The characteristic requirements of certain groups of vegetable crops are as follows:—

Group I—Turnips, radish, carrots etc.—principally phosphates with a liberal supply of potash and small amount of nitrogen.

Group II—Potatoes and onions.—principally potash with moderate amount of phosphates and small amount of nitrogen.

Group III—Cabbage, lettuce and other leafy vegetables—principally nitrogen with a liberal quantity of phosphates and small amount of potash.

Group IV—Peas, beans, melons, cucurbits, tomatoes and cualiflowers—phosphates and potash with a small amount of nitrogen.

The fertiliser requirements in respect of the above four groups of crops can be supplied by the following mixtures of fertilisers which should be applied to the respective crops at the rate of 2 to 4 ozs. per square yard. The fertiliser mixtures should as far as possible be prepared just before they are required to be applied:—

Fertilisers employed in preparing the required mixtures	Groups of vegetable crops. I	II	III	IV
Superphosphate	6	4	2	6
Potassium sulphate	2	3	1	3
Ammonium sulphate	1	1	2	1

Fruit crops.—Fertiliser requirements of field crops and vegetables differ considerably both in respect of the proportions and quantities of the three fertilising constituents from those of perennial fruit trees which occupy the land for several years, and in addition young and old fruit trees differ in their fertiliser requirements. Young trees use their food supply in the formation of wood and leaves and for the first few seasons—varying within certain limits with various fruit crops—they grow vigorously. When the bearing period is reached, a gradual change comes about; the trees do not grow so rapidly and a large portion of the

food supply is directed towards fruit formation. Young trees therefore generally require a larger amount of nitrogen than that required by bearing trees. The amount of fertiliser required depends on the age, size of the crop, and the amount of fertility already present in the soil.

Requirements of the important fruit crop of the Province namely the orange are given below :—

For young trees, the fertiliser should contain about 6% phosphoric acid, 8% potash and 4% nitrogen while one containing 8% phosphoric acid, 10 to 12% potash and 3 to 4% nitrogen should be applied to the grove of bearing trees.

Quantities of the complete fertiliser mixtures required per plant during its growth are as follows :—

1st year	....	3 lbs.
2nd year	...	4½ lbs.
3rd year	...	5 to 6 lbs.
4th year	...	6 to 9 lbs.
5th year	...	9 to 12 lbs.
6th year	...	10 to 15 lbs.

Bearing trees, about 8 to 15 years old, should have from 10 to 30 lbs. per tree of the fertiliser of the formula for bearing trees given above. Two typical fertiliser mixtures calculated on the basis of 100 lbs. for young and bearing trees are given below, and others can be prepared depending upon the cost and availability of various fertilisers whose approximate composition is also given below :—

I Fertiliser mixture for young trees

Superphosphate	...	...	30 lbs.
Potassium sulphate	...	...	16 lbs.
Oil-cake	...	...	44 lbs.
Ammonium sulphate	...	...	10 lbs.
		Total	100 lbs.

II Fertiliser mixtures for bearing trees.

Superphosphate	...	...	...	40 lbs.
Potassium sulphate	...	...	...	20 lbs.
Oil-cake	...	...	...	30 lbs.
Ammonium sulphate	...	...	...	10 lbs.
			Total...	100 lbs.

Any oil-cake except *Mahua* cake can be employed in the preparation of the mixtures given above.

Average composition of some common manures and fertilisers

Names of manures and fertilisers.	Percentages in air-dry samples.		
	Phosphoric acid. (P_2O_5)	Potash. (K_2O)	Nitrogen.
Ammonium sulphate ...	Nil	Nil	20.0
Sodium Nitrate ...	Nil	Nil	15.0 to 16.0
Oil-cakes :—			
Til, Karanja, castor, cotton, sarson, and linseed ...	1.0 to 2.0	1.0 to 2.0	4.5 to 5.0
Groundnut cake ...	1.0 to 1.5	1.0 to 1.5	7.0 to 8.0
Cowflesh manure ...	...	...	11.0
Fish manure ...	3.0	...	4.0
Nicifos, grade I ...	48.0	Nil	13.0
Nicifos, grade II ...	18 0	Nil	18.0
Bone superphosphate (single) ...	20.0	Nil	Nil
Double superphosphate ...	40 0	Nil	Nil
Sulphate of potash ...	Nil	50.0	Nil
Muriate of potash ...	Nil	50.0	Nil
Kainit ...	Nil	20.0	Nil

Although the exact quantities of fertiliser constituents to be applied to various crops will depend on the nature of the soil, climate, economic considerations and the like, a comparative statement showing the average fertiliser requirements of some important crops is given below :—

	Fertilising constituents in lbs. per acre		
	Nitrogen.	Phosphoric acid (P_2O_5).	Potash (K_2O).
Rice ...	20 to 40	40 to 80	25 to 50
Wheat ...	20 to 40	40 to 80	25 to 50
Potato ...	60 to 100	60 to 100	100 to 200
Cotton ...	20 to 40	40 to 100	50 to 100
Tobacco ...	10 to 20	30 to 50	50 to 75
Mango and guava ...	40 to 50	80 to 120	100 to 150
Bananas ...	60 to 100	80 to 150	100 to 200
Chillies and ginger ...	40 to 70	80 to 150	75 to 175
Sugar-cane ...	60 to 110	60 to 120	60 to 125

POSSIBILITIES OF FRUIT PRESERVATION IN THE CENTRAL PROVINCES AND BERAR AND GENERAL PRINCIPLES OF PRESERVATION

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The normal fruit crop in this Province is a valuable one though fruit growing in general needs extension and improvement. It is in the interest of the growers and public alike that the fullest possible use should be made of fruits grown in orchards and to this end larger quantities should be preserved in the seasons of plenty, for use at other times of the year.

Fruit and vegetable products have for centuries past been prepared in the house-hold and formed an important part of the diet of man. The pickling of lemons and raw mangoes, preparation of mango preserves are primary industries and their recipes are handed down from generation to generation. Their value must be recognised though modifications must be made in them so as to conform them to the scientific principles now known to be the basis of these practices. In the following series of articles various simple methods of preservation—old and modern will be described and the scientific principles underlying them will be discussed. The recipes given for the common fruits of our Province may be found to give satisfactory results, though amendments will no doubt become necessary as the quality of fruits changes. They may prove of service generally to those who grow fruits and vegetables or can acquire cheap supplies from outside for preservation purpose.

Position of fruit cultivation in the Central Provinces :—The Province though known for its Nagpur oranges is not famous for fruit cultivation. In the first place it lacks in the variety of fruits and secondly the intensity of cultivation. The main fruits of the Province are orange, mango, guava and bananas. Out of these Nagpur oranges are grown most extensively and the area under it has increased from 5,600 acres in 1929—30 to 12,812 acres in 1938—39. The estimated crop for the quinquennium 1933—37 was 145 million oranges per year. Nagpur orange trees bear fruit twice a year. The first blossom called the "*Mrig-Bahar*" comes in bearing during the months of March, April and May. The second blossom called the "*Ambia Bahar*" comes to bearing in the months of October, November and December. The fruits have great demand during summer months while in the cold season they have comparatively less demand. A great surplus of lower grade oranges that is left requires to be utilised profitably. There is a big crop of lemons in the Province and is consumed either as

fresh or pickled. There is a glut in the market in season when they are sold at very cheap prices.

Mango, the king of fruits, is also grown on a large scale though the crop of high quality i. e. grafted mango is limited. The peculiarity of this fruit is that though the crop is abundant, the season is very limited. It has a demand in off season if it is preserved and sold at cheap price.

The cultivation of guava is becoming popular though the estimate of the crop is not known. It is grown on large scale in Chattisgarh.

Plantains are grown all over the Province and pay well. Jamun (Evgenia jambolina) grows naturally in the country side and its utilisation deserves attention. Other fruits like *Phalsa* (Grewia asiatica), Chiku (Achros Sapota), Custard apple, (Anona squamosa) are grown in places and consumed only as fresh fruits.

The fruit growing in the Province might be extended immensely if better market facilities are provided and strenuous efforts are made at utilisation of good quality as well as low grade fruit in the manufacture of primary fruit products and by products.

Scope of fruit preservation :— Fruit products present a large variety and include bottled and canned fruit, jams, jellies, preserves, syrups, squashes candied fruits and pickles. Canning of orange, guava and mango does not offer very bright prospects at present on account of three main problems, supply of raw material of uniform quality, standardized process of canning these fruits and marketing of these products within and without India. Canning of mango has been tried at several places in India and canning mango is a line that offers most hope. Canning trials on Nagpur oranges were made at the Fruit and Vegetable research station Campden, England in 1936. While the flavour of the oranges canned was quite satisfactory the covering liquid remained rather cloudy. A good deal of experimentation needs be done on this fruit and then it will have to be seen if it is able to compete the Japanese canned manderines.

On the whole in our Province there seems much hope for the development of manufacture of fruit juices and squashes, jams, jellies and pickles. Manufacture of orange and lemon squashes and orange marmalade offer a bright chance and their production on commercial scale could be undertaken by controlling the quality and standardizing the process.

Preparation of by products such as pectin, orange oil and citric acid from Nagpur oranges requires a thorough investigation so as to make the best use of culled oranges which are available in plenty during season,

Definition of preservation.—Preservation means keeping fruits in good condition for human consumption for a longer time than they ordinarily would remain. A fruit plucked from the tree is not a dead mass, it is subject to the cycle of perpetual building up and breaking down of its tissues. Its preservation, therefore, is merely a method of checking the natural cycle so that the agents of destruction causing decomposition of fruit tissue are destroyed.

Agents of destruction.—The agents of destruction and decomposition are classified under four headings yeasts, moulds, bacteria and enzymes. The first three are microscopic organism while the fourth are chemical substances present in fruits. A little information about their life cycle will not be out of place and might help in elucidating the principles of fruit and vegetable preservation.

Yeasts.—Yeasts are minute single celled organisms of oval shape which multiply by the process known as budding, the new cell splitting off from the end of the mother cell as the latter reaches maturity. Yeast cells are always present in the air and consequently abound on the surface of fresh fruit. Fortunately yeast cells are highly susceptible to heat and can easily be destroyed by exposure to a high temperature of 165^0 F for a few minutes. Yeasts can do no damage in causing fermentation of jams, fruits juices, sugar syrups etc.

Moulds.—Moulds are distinguished by formation of mycelium which is a network of filaments or threads called the hyphae and are usually visible to the unaided eye. The green moulds commonly seen on the surface of jam has a brush like appearance and for this reason is called Penicillium. Other common types are known as Aspegillus and Mucor. The spores are produced in enormous numbers and they are easily detached and carried away in the air. Each spore is capable of producing a fresh mould growth if it falls, on a food material where the conditions for growth are suitable. They are easily destroyed by heat, a few minutes exposure at a temperature of 165^0 F being sufficient to kill them.

Bacteria.—The smallest and simplest forms of life are known as bacteria. They consist of single cells, which reproduce simply by dividing into two. This division takes place so very rapidly that within a few hours one single cell may develop into many millions if conditions are suitable. Certain types of bacteria have the capacity of producing a comparatively thick walled cell called a spore when the conditions for production of the normal vegetative type are unsatisfactory. These bacterial spores are much more resistant to heat than the vegetative

forms which are generally destroyed by heating for a short time. They are however, highly sensitive to the presence of acids and in consequence the acid fruits are much easier to sterilize than vegetables. The development of bacteria in canned and bottled goods can easily be prevented by carrying out the correct procedure recommended for the sterilization of the particular fruit and vegetable.

Enzymes.—These chemical substances are present in all living material and are agents which cause ripening of fruit, browing of apple slices on exposure to air and deterioration of fruits and vegetables on storage. They are highly sensitive to a rise of temperature and are destroyed during sterilization.

Principles of Preservation (i) Sterilization by heat:—Yeasts, moulds, bacteria and enzymes can be destroyed by heat. Sterilization by means of heat is one of the most convenient ways of preserving fruits and vegetables and has been used in canning and bottling processes. Temperature has to be regulated properly so as to preserve the body, flavour and taste of fruits and though the principlo is the same, the process for different fruits differs in details according to the peculiarities of those fruits. The sterilization will not be of any avail unless care is taken to see that the cans and bottles are sealed airtight so that unsterilised air cannot enter. If there is the smallest leak, air will be drawn into the container and this almost certainly means the introduction of many airborne micro organisms which on development will render the contents unfit to eat.

2. **Preservation by antiseptics**:—Sugar, salt and vinegar so commonly used in foodstuffs are chemical preservatives in as much as they make the food unsuitable for use by mirco organisms. Sugar should be used in large quantities if it is to act as preservative. Spoilage bacteria will not develop in sugar solutions of 40—50% but certain yeasts and moulds are able to develop in much higher concentrations. Thus in making jam it is necessary to have about 70% of sugar present or the jam will not keep. Sugar acts by osmosis and not as a true micro organism poison. In crystallising the fruit is impregnated with sugar and the moisture is removed by drying. Salt is used very largely for preserving food and it acts both by osmosis and as a micro organism poison. Salt and organic acids are the chief preservatives in pickles, the spices possessing little or no antisceptic action. Vinegar which is universally used as a food preservative acts as micro organism poison. The active principle of vinegar is acetic acid. Besides these preservatives other chemicals such as sodium Benzoate and Sulphurous acid are used at present. 0.2 per cent

of these will prevent the spoiling of most food products. The only drawback with these in comparision to sugar, salt and vinegar is besides their preservative action if used in large quantities they make preserved products unsuited for human consumption. The use of chemical preservatives is therefore governed by national Food laws. Sodium benzoate and sulphurous acid should not be used more than 200 parts per million according to Food laws.

Drying :—Preservation by drying depends upon reducing the moisture content at a point at which the concentration of the dissolved solids in the product is as high as 65% or above so that osmotic pressure will prevent the growth of micro organisms. Enzyme action is completely arrested on dehydration. Removal of water from foods for the purposes of preservation has been practised for hundreds of years and in early days heat of the sun was utilised for this purpose. Now dehydraters are invented to serve the same purpose with more exact regulation of temperature and with a view to prevent loss from humid weather. In India the natural method is still used for drying of bananas, figs, dates, grapes and vegetables.

RESPONSE OF WHEAT TO NICIFOS II ON 'KANHAR' SOILS IN CHHATTISGARH

BY MR. S. N. WALKADE, B. Ag.

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Introduction :—Wheat occupies an area of over two and quarter lakhs of acres in the Chhattisgarh tract comprising of Drug, Bilaspur and Raipur Districts. About half of this wheat area is in the Drug District.

The soils associated with the wheat crop are commonly known as "Kanhar" and "Dorsa". Dorsa is a medium clay, fairly retentive of moisture, while "Kanhar" is a stiff clay resembling black cotton soils of Berar with poor drainage and hence subject to water-logging during rains.

Layout of the Experiment :—Effect of Nicifos II on wheat in differen, doses has been investigated at the Government Experimental Farmt Labhandi, Raipur, on "Kanhar" soil both under Bunded and "Open" system of cultivation during the quinquennium 1935-40. The variety chosen is A 113. The layout of the experiment is of randomised type, ultimate plot size being 1/30th acre. The treatments are replicated six times, the treatments being :—

(i) No manure (control).
(ii) Nicifos II — 50 lbs per acre.
(iii) Nicifos II — 100 „
(iv) Nicifos II — 150 „

Nicifos II also contains equivalent quantity of P_2O_5. The fertiliser is drilled in with the seed.

The Soil Analysis and Rainfall:—The chemical and mechanical analyses of the "Kanhar" (1) soil are as given in Table I. Rainfall during the quinquennium is shown in Table II.

TABLE I

Chemical Analysis	Per cent.	Mechanical Analysis	Per cent.
Insoluble silicate and Sand ...	69.73	Coarse sand	0.60
Ferric Oxide	7.64	Fine sand	4.04
Alumina	13.83	Silt	12.66
Lime	1.05	Fine silt	19.97
Magnesia	0.75	Clay	53.00
Potash	0.79	Moisture	2.44
Soda	0.25	Ignition loss	7.82
Phosphate	0.02	Calcium carbonate ...	0.22
Sulphuric acid	Nil		
Carbonic acid	0.08		
Organic matter and combined water	5.86		
Total ...	100.00	Total...	100.75
Total Nitrogen	0.036		
Available phosphoric acid ...	0.001		
Potash	0.12		

TABLE II

Rainfall in inches

Month	Fortnight	Years				
		1935-36	1936-37	1937-38	1938-39	1939-40
April	First	0.69	0.30	3.23	...	0.26
	Second	0.48	...	1.86	...	...
May	First	0.05	...	...	0.20	...
	Second	...	1.35	0.07	2.29	....
June	First	3.27	7.72	0.73	10.24	0.90
	Second	4.63	7.89	15.15	9.74	3.27
July	First	4.12	5.21	13.97	4.60	8.82
	Second	8.78	17.31	18.75	6.11	5.71
August	First	5.57	6.90	22.27	5.41	3.01
	Second	3.46	18 62	11.48	6.44	20.24
September	First	5.20	6.37	8.50	4.91	3.13
	Second	3.54	7.61	...	0.49	0.32
October	First	...	4.57	2.65	3.39	0.04
	Second	...	0.35	...	...	1.87
November	First	...	2.15	...	...	...
	Second	...	1.70	...	0.27	...
December	First	...	...	...	...	...
	Second	...	0.12	...	...	...
January	First	...	...	...	...	...
	Second	2.35	...	...	...	...
February	First	0.92	1.63	1.39	0.53	0.52
	Second	1.00	1.62	...	...	...
March	First	...	...	...	0.13	...
	Second	1.04	1.60	0.05	1.83	0.03
	Total...	45.10	93.02	100.10	56.58	48.12

Analysis of Variance :—The yield of grain per plot for each year is given in appendix "A" and the analysis of variance for each year in Table III. The allocation of the amount of variation in the yield due to various causes over a series of five years is shown in Table IV, both for "embanked" and "open" fields.

TABLE III

Due to	D. F.	Mean Squares					
		1935-36		1936-37		1937-38	
		Em-banked	Open	Em-banked	Open	Em-banked	Open
Blocks	5	18.95	11.82	37.82	29.64	12.19	23.81
Treatment	3	209.51	150.53	317.40	366.63	384.62	167.16
Error	15	4.17	2.31	10.94	23.25	13.77	4.09
F. (Treatment)		50.24	65.16	29.01	15.77	27.93	40.87

TABLE III—*(continued)*

Due to	D. F.	Means Squares			
		1938-39		1939-40	
		Embanked	Open	Embanked	Open
Blocks	5	5.17	10.29	73.67	70.07
Treatment	3	234.07	209.93	163.83	293.22
Error	15	20.46	30.40	16.40	15.55
F. (Treatmet)		11.44	6.90	9.99	18.86

$$\left.\begin{matrix} N_1 = 3 \\ N_2 = 15 \end{matrix}\right\} \quad \begin{matrix} 5\ \%\ F = 3.29 \\ 1\ \%\ F = 5.42 \end{matrix}$$

TABLE IV

Due to	D. F.	Embanked field				Open field			
		Mean squares	F.	F 5 %	F 1 %	Mean squares	F.	F 5 %	F 1 %
Blocks	25	29.6399	...	...	...	30.3246	...	...	...
Seasons	4	44.4732	3.38	2.50	3.58	148.1057	11.89	2.50	3.58
Treatment	3	1252.3787	95.26	2.73	4.06	1141.3965	91.65	2.73	4.06
Interaction S x T	12	14.2627	1.08	1.89	2.44	11.5190	0.92	1.89	2.44
Error	75	13.1469	...	...	...	12.4535	...	...	...

It will be observed that in all the years both in the "embanked" and "open" fields the mean square due to treatments with 3 D. F. is significantly greater than the error mean square with 15 D. F. Similarly the five year analysis clearly indicates that the treatment effect is significant.

The seasonal effect is also significant. It will be observed that the mean square due to season in the "open" field is comparatively much higher than the mean square due to season in the "embanked fields." This shows that the response to application of fertilisers greatly varies from season to season in the "open fields" as one would expect, due to the moisture factor than in the "embanked fields" where the moisture factor is not expected to be so variable. The interaction of treatments with season is significant under both set of experiments.

The plot error percent under "bunded fields" and "open" ones ranges between 8.51 to 21.08 and 8.56 to 28.19 respectively.

Response to increasing doses of the fertiliser.—The mean yields per acre, for the different treatments for each year, both under "embanked" and "open" fields, together with the standard errors are shown in Table V.

TABLE V

Mean yield in lbs. per acre

Treatment	Field	1935—36	1936—37	1937—38	1938—39	1939—40	Average
Control	Embanked	501	336	419	393	490	428
	Open	338	301	290	336	435	340
Nicifos II, 50 lbs.	Embanked	605	613	645	630	680	635
	Open	552	560	498	601	660	568
Nicifos II, 100 lbs.	Embanked	830	751	808	718	835	788
	Open	568	681	593	665	770	655
Nicifos II, 150 lbs.	Embanked	893	833	983	835	805	870
	Open	702	859	651	746	935	779
Mean yields	Embanked	707	633	714	644	703	680
	Open	540	600	508	587	700	587
S. E.	Embanked	25.0	40.5	45.4	55.4	49.6	19.86
	Open	18.6	39.0	24.8	57.5	48.3	19.33

It will be observed that both in the "embanked" and in the "open" fields the application of Nicifos II has given significantly higher yields than the no manure plots, increasing outturns being obtained by the application of increasing doses of the fertiliser. The successive differences in yields on the five year average both under "embanked" and "open" conditions are significant. In the individual years of harvest, however, under "embanked" conditions the differences in yield obtained by the application of 100 and 150 lbs. Nicifos II per acre are not significant as judged in the light of the standard error, except for the year 1937-38, while difference in yields obtained between plots receiving 50 and 100 lbs. Nicifos II, per acre is significant for all the years except in 1938-39. On the whole this indicates the optimum application of 100 lbs. Nicifos II under "embanked" conditions.

The results for the individual years in the case of the "open" fields are rather interesting. It will be observed in general that the difference in yields between those plots treated with 100 lbs. and 150 lbs. Nicifos II are greater than those between plots receiving 50 and 100 lbs. Nicifos II except in 1937-38. The differences are significant except for the two years 1937-38 and 1938-39. Only in one year viz., 1937-38 is the difference in yields between plots receiving 50 lbs. and 100 lbs. Nicifos II per acre significant.

On an average of five years, the mean yields obtained from an "embanked field" is 680 lbs. per acre as against 587 lbs. obtained from the "open field", the difference being equivalent to money value of Rs. 3/11/-, if wheat is selling at 25 lbs. per rupee. In individual years also increased yields are obtained in the case of "embanked fields." In the years 1936-37 and 1939-40, however, mean yields in the "embanked fields" receiving 150 lbs. Nicifos II per acre are slightly lower than that received under comparative treatment in the "open fields." The differences are, however, not statistically significant. It may be stated that conditions favourable for rust prevailed in the 1936-37 season and so one would expect more damage particularly under heavy manuring in the "embanked fields".

The utility of embanking fields where soil and climatic conditions are favourable in building up soil fertility, saving of labour and affording protection to crops against failure of late monsoon rains, which are so important for rabi sowing, is now recognised by the cultivators.

Economics of manuring.—The economics of manuring is purely a question of prices of the fertilisers and grain prevalent in a particular

period. There is a considerable rise in the prices of the fertiliser of late, due to war conditions, while although the prices of the wheat are now higher, the rise is not proportionate to the rise in the prices of the fertiliser. Taking the cost of Nicifos II at Rs. 8/2/- per 100 lbs. and of wheat at 25 lbs. per rupee, the statement of profit and loss due to application of fertiliser is as shown in Table VI.

TABLE VI

Economics of Manuring

Treatment	Extra yield over control in lbs.		Value in Rs. at 25 lbs. per rupee		Extra cost of manure over no manure plot	Extra Profit (+) Loss (−)	
	Embanked	Open	Embanked	Open		Embanked	Open
	lbs.	lbs.	Rs.	Rs.	Rs.	Rs.	Rs.
Nicifos II per acre :—							
50 lbs.	207	228	8 4 6	9 2 0	4 1 0	+4-3-6	+5-1-0
100 "	360	315	14 6 6	12 9 6	8 2 0	+6-4-6	+4-7-0
150 "	442	439	17 11 0	17 9 0	12 3 2	+5-8-0	+5-6-0

The results show that application of Nicifos II to the wheat crop at the rate of 100 lbs. per acre has been found to be most economical for the "embanked field" (2). Under "Open conditions" (2) application of 50 lbs. Nicifos II per acre seems desirable although slightly more profit is shown by the application of 150 lbs. Nicifos II over a period of 5 years. The prices of Nicifos II have gone considerably high due to war at the present. Even taking the current rate of Rs. 12-2-6 per 100 lbs. of Nicifos II and selling price of wheat at 20 lbs. per rupee the conclusions remain unaffected.

Kalamkar and Tiwari (3) have observed that the application of 15 lbs Nitrogen in the form of Nicifos II equivalent to 83 1/3 lbs. was profitable in the Haveli lands in the Jubbulpore District. Drillling of the fertiliser with the seed instead of broadcasting it appears to be a desirable practice. Churchill (4) noticed the advantage of sowing of the fertiliser with the seed as early as 1935 and it has now been a common practice adopted on the Farms.

Summary and conclusions.—The note briefly deals with the response of A 113 wheat to the application of Nicifos II in different doses under

"embanked" and "open" fields of "Kanhar" soil in the Chhattisgarh tract. The data extend over a period of five years.

Under "embanked field" system, the average yield of wheat was 680 lbs. as against 587 lbs. in the "open fields" which represent about Rs. 3-11-0 gain per acre in favour of "embanked fields", even ignoring the fact that the cost of cultivation in the bunded field is comparatively less than that under open condition.

Application of Nicifos II drilled with seed at the rate of 100 lbs. per acre in the case of "embanked fields" and 50 lbs. in the case of "open fields" seems to be an optimum does yielding about Rs. 5/- to 6/- as extra net profit over the un-manured plot.

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Farm — Labhandi
Class — Manurial
Crop —A—113—Wheat

APPENDIX A.

TO STUDY THE EFFECT OF NICIFOS II IN OPEN FIELDS ON UNIRRIGATED WHEAT

Area of plot — 1/30th acre. Yield of grain — In lbs.
Layout — Randomised blocks. Replications — Six.

Treatments.	1935—36						1936—37					
	1	2	3	4	5	6	1	2	3	4	5	6
1. No manure—(Control) ...	12.6	12.2	12.5	9.7	8.1	12.5	8.0	10.0	6.2	11.5	10.7	13.7
2. Nicifos II 50 lbs. per acre ...	16.2	20.2	19.1	15.2	15.1	18.5	16.5	18.5	18.7	18.7	19.5	20.0
3. Nicifos II 100 lbs. per acre ...	19.2	19.5	20.7	16.2	15.7	22.2	20.7	23 7	18.2	21.2	36.2	16.2
4. Nicifos II 150 lbs. per acre ...	20.1	23.7	23.4	22.7	24.2	26.2	25.7	20.7	28.5	26.5	30.7	39.7
	1937—38						1938—39					
1. No manure—(Control) ...	7.0	10.5	10.0	8.5	10.0	12.0	12.2	12.7	10.7	13.2	7.2	11.2
2. Nicifos II 50 lbs. per acre ...	14.0	18.5	17.0	15.5	17.0	17.5	30.7	18.7	19.7	14.5	15.0	21.5
3. Nicifos II 100 lbs. per acre ...	15.5	22.5	21.0	17.5	18.5	23.5	17.5	19.2	25.5	23.7	23.5	23.5
4. Nicifos II 150 lbs. per acre ...	18.5	23.0	19.0	16.0	27.2	26.5	29.0	21.5	24.5	27.5	26.7	20.0
	1939—40											
1. No manure—(Control) ...	15.0	16.0	13.0	12.0	14.0	17.0						
2. Nicifos II 50 lbs. per acre ...	26.0	25.0	29.0	14.0	18.0	20.0						
3. Nicifos II 100 lbs. per acre ...	31.0	31.0	29.0	24.0	22.0	17.0						
4. Nicifos II 150 lbs per acre ...	43.0	34.0	34.0	23.0	24.0	29.0						

Farm — Labhandi
Class — Manurial
Crop —A—113—Wheat

APPENDIX A.

TO STUDY THE EFFECT OF NICIFOS II IN EMBANKED FIELDS ON UNIRRIGATED WHEAT

Area of plot — 1/30th acre. Yield of grain — In lbs.
Layout — Randomised blocks. Replications — Six.

Treatments.	1935—36						1936—37					
	1	2	3	4	5	6	1	2	3	4	5	6
1. No manure—(Control) ...	14.8	14.5	16.1	19.1	16.5	19.2	12.7	10.5	11.7	9.5	10.2	12.5
2. Nicifos II 50 lbs. per acre ...	19.6	20.2	23.6	21.7	25.9	19.9	16.2	23.5	22.5	17.2	17.7	25.5
3. Nicifos II 100 „ per acre ...	22.9	26.9	25.4	27.7	33.2	29.9	18.7	35.0	25.0	16.2	26.4	28.9
4. Nicifos II 150 „ per acre ...	24.2	29.5	31.7	31.9	31.1	30.2	27.1	29.7	31.5	23.7	27.4	27.2
	1937—38						1938—39					
1. No manure—(Control) ...	9.5	15.0	18.5	15.5	12.2	13.0	8.0	17.0	17.0	11.0	14.5	11.0
2. Nicifos II 50 lbs. per acre ...	21.0	20.7	15.0	19.0	26.0	27.2	18.0	19.0	26.0	26.0	20.5	16.5
3. Nicifos II 100 lbs. per acre ...	24.2	27.7	25.5	28.0	30.7	25.5	31.0	21.0	26.5	16.0	24.0	25.0
4. Nicifos II 150 lbs. per acre ...	29.5	34.0	36.0	28.0	30.0	39.0	32.0	28.0	24.0	29.0	24.0	30.0
	1939—40											
1. No manure—(Control) ...	15.0	16.0	15.0	19.0	18.0	15.0						
2. Nicifos II 50 lbs. per acre ...	21.0	16.0	25.0	24.0	27.0	23.0						
3. Nicifos II 100 lbs. per acre ...	18.0	29.0	25.0	35.0	38.0	22.0						
4. Nicifos II 150 lbs. per acre ...	27.0	24.0	23.0	32.0	37.0	18.0						

Extracts

ENTOMOLOGY IN INDIA—A RETROSPECT

In a country almost completely steeped in religious and philosophical ideas from time immemorial, the biological seicnce, especially subjects like Entomology, Helminthology, Ornithology, etc., had very few chances of receiving any serious consideration at the hands of even highly educated Indians in the past. While we could think of several eminent Indian names in connection with subjects like Astronomy, Mathematics, Literature, History or Philosophy, we can hardly recall any Indian names associated with the natural sciences, similar to those of Aristotle, Pliny, Linnaeus, Cuvier, Fabricius or Darwin, who are but a few of the many distinguished pioneer naturalists of Europe. In most western countries we commonly come across men in whom a love of nature is fostered from early childhood and we even find persons of diverse occupations who take to the study of plants and animals as a hobby. On the other hand, very few people among us display any interest in or leaning towards natural objects, especially the lower forms of life. It is certainly not because Indians are unfit for this work, as may be found form the number of Indian botanists and zoologists we have in the country at present day, but only because of the peculiar attitude we have been trained to exhibit towards natural objects, especially small and insignificant forms like worms, insects, spiders, etc., we have been unfortunately trained to look upon such creatures with an instinctive aversion, and as things which are unworthy of any serious attention.

It may be stated, however, that in spite of the fact that men in the West usually displayed some interest in natural history, even there a subject like Entomology and its votaries were not free from reproach or contempt, as may be gethered from the following remarks of Spence in the preface to his "*Introduction to Entomology*" published early in the last century.

" One principal reason of the little attention paid to entomology in this country, has doubtless been the ridicule so often thrown upon the science. The botanist, sheltered now by the sanction of fashion as formerly by the prescriptive union of his study with medicine, may dedicate his hours to mosses and lichens without reproach; but in the minds of most men, the learned as well as the vulgar, the idea of the

trifling nature of the entomologists' pursuit is so strongly associated with that of the diminutive size of the objects, that an entomologist is synonymous with everything futile and childish. Now, when so many other roads to fame and distinction are open, when a man has merely to avow himself a botanist, a mineralogist, or a chemist a student of classical literature or of political economy to ensure attention and respect, there are evidently no great attractions to lead him to a science which in nine companies out of ten with which he may associate, promise to signalize him only as an object of pity or contempt."

In the article on 'Entomology' in the Oxford Encyclopædia of 1828 is found the following statement :—

"There is not, perhaps, any branch of natural history the study of which has been so generally regarded with indifference and contempt. The insect hunter is not infrequently treated with ridicule and his pursuit branded as frivolous."

We can easily realize how under such comparatively unfavourable conditions existing even until recent years, a science like Entomology did not have any chance of progressing or thriving like the many sister sciences in which India had already established a fame. Nor was there sufficient encouragement from educational institutions and Governments to the study of the natural sciences, and subjects like Botany and Zoology were practically the latest to receive any recognition and patronage from the Indian universities. Entomology is still kept in the background and has not yet received the attention which it deserves, considering its scientific and great economic importance. However, due to various influences chiefly of an economic nature, conditions are changing and a marked reaction is evident at present. Both laymen and scientists in the country have begun to realise that of all lower animals, insects play a very important role in many departments of human activity. The recent discoveries by eminent men of science that small and apparently innocent creatures like the housefly, the mosquito and the bed bug are capable of disseminating some of the deadliest human diseases, have more than anything else brought to the foreground the importance of the study of insects and allied forms; and it is hoped that Entomology in India might in the coming years receive its due share of recognition, especially at the hands of our own countrymen.

INSECT LORE IN ANCIENT INDIA

The absence of any very noteworthy literature on insects or of the names of any Indian entomologists in the past does not, however,

warrant us to conclude that people in ancient India did not possess any knowledge of lower animals. While there is little doubt that our ancestors had a fairly good acquaintance with some general facts of bionomics of many higher animals as may be found from numerous references, especially in the epics, *Ramayana and Mahabharata*, we cannot but admit that the knowledge possessed by Indians in the past regarding lower animals was comparatively very meagre and often imperfect or even erroneous. Some of the references, however, appear very interesting and noteworthy; the occurrence of such terms as *Pathanga Bhramara, Shadpada, Pipilika, Makshika,* etc. in ancient Sanskrit writings are instances to prove that our people were not altogether ignorant of insects and some of their ways. In *Amarakosa*, the well known dictionary of Sanskrit synonyms, seven lines in verse refer to insects of different kinds such as flies, beetles, bees, hornets, moths, ants and glow-worms. It will also be interesting to note that the famous physician Susrutha has even gone to the extent of classifying ants (*Pipilika*) into six groups,* and the nomenclature of these divisions also shows considerable powers of observation on the part of the author, of the structure and habits of those insects. We have also evidence to prove that people in many parts of India had some knowledge of the lac (*Laksha*)** dye as may be gathered from references to this substance in ancient Sanskrit works like *Chanakyasutra, Sakuntala,* etc. The story in the *Mahabharata* of the house of lac constructed by the *Kauravas* to destroy their cousins, the *Pandauas,* is another well known old reference to the lac insect. Furthermore, from time immemorial people all over India have been familiar with bees (*Madhu makshika*) and the gathering of honey and wax from their hives. Before leaving this account of the science in ancient India it may be interesting to refer to the story of the boy sage *Mandavya* in the *Mahabharata,* who had the habit of collecting and pinning insects and who had to pay a heavy penalty for this act by being himself impaled on the point of a sharp crowbar; this is a bit of the of the biography of the first Indian insect collector.

ENTOMOLOGY IN MODERN INDIA

While the scientific study of insects in the west might be traced to the days of Aristotle (4th century B. C.), we in India need not extend our researches further back than the middle of the 18th century for any

* (1) *Sthula siras* (2) *Sam vahika* (3) *Angulika* (4) *Brahmanica* (5) *Kapilika* (6) *Chitravarna* and the name *Amba Kapilika* was applied to the white-ant queen (*Vide Mem. As. Soc. Bengal 1.1905*).

** *Laksha,* meaning a hundred thousand, refers to the countless minute lac insects.

accurate records of reliable scientific work on the subject. The different stages in the gradual development of entomological work in India could be conveniently treated under three distinct periods thus :—the first from the advent of the early christian missions and the East India Company up to the middle of the 19th century; the second half of the last century marks the next period; and the third might be marked off from the beginning of the present century.

FIRST PERIOD (1779 TO 1850)

As far as the writer is aware, regular work on Indian insects on modern scientific lines was first initiated in South India, and the pioneer worker in this line was Dr. J. G. Koenig (a pupil of the great naturalist Linnaeus). Dr. Koenig was at first a medical officer to the Tranquebar mission and later was for some time official naturalist to the then Nawab of Arcot (one wonders whether any of our present day nawabs or zamindars employ a naturalist ?). He collected both plants and insects from the Coromandel coast and supplied plenty of material to famous European systematists like Linnaeus, Fabricius, Cramer, Drury, and in addition he made a special study of the termites of the Tanjore district. His detailed work on this group was published in the fourth volume of *Beschaftigungen der berlinischen Gesellschaft Naturforchender Freunde** in the year 1779, and this exceedingly interesting account may be regarded as the first really scientific contribution on Indian insects. From this time onwards we have records of several other naturalists, and the rapid progress of work in those days was considerably due to the scientific enthusiasm and a spirit of exploration, rather than personal gain, on the part of many of the officers of the East India Company and the early Christian Missions in South India. In 1782 Dr. Kerr published an account of the "lac insect" and three years later, the Asiatic Society of Bengal was started in Calcutta under the distinguished patronage and leadership of the great jurist and orientalist Sir William Jones. The inauguration of this Association for literary and scientific development in India was an epoch-making event as can be judged by the hundreds of contributions which have appeared in the Society's publications since 1788. Dr. Roxburgh, the famous Botanist, contributed a detailed account of the lac insect to the '*Asiatic Researches*' in 1790. In 1791, Dr. J. Anderson, Physician-General to the East India Company at Madras, issued a monograph on the "Cochineal" or-scale insects (Coccidae). In 1800, the famous traveller

* An English translation of this account is given by Fletcher Vide *Rep. Pro. IV Ent. Meet., Pusa,* 312—333. 1921.

Buchnan wrote, not only on the cultivation of the lac insect in India, but also recorded some valuable observations on silk worms and their culture in some parts of South India. It was only in the beginning of the 19th century, however, that the first general work on insects in Asia appeared and this was E. Donovan's *Natural history of insects*, a publication which was later (1842) revised by the famous British Entomologist, J. O. Westwood who added good illustrations and descriptions of the insects. In 1840, a paper on the "Entomology of the Himalayas and India" appeared in *Madras Journal of Literature and Science* under the authorship of Rev. F. W. Hope. During the same period the classical works of Westwood entitled *Cabinet of Oriental Entomology* and *Arcana Entomologica* appeared and the former which came out in 1847 attracted a good deal of attention from European settlers in the East and created an enthusiasm and impetus in many of them to carry on entomological work, as had been anticipated in author's introductory remark.

SECOND PERIOD (1850-1900)

During the second half of the nineteenth century the study of scientific subjects in India received great impetus by the foundation of institutions like the Indian Museum at Calcutta in 1875 and the Bombay Natural History Society in 1883. Very useful work has been done on insects by the officers of the Indian Museum and the publications of the Asiatic Society of Bengal teem with their papers on insects of various groups, which it is not possible to list in this brief review. The Bombay Natural History Society issued the first number of its journal in 1888. Since that date, the Society has continued to be a very popular institution and numerous papers on insects by many distinguished workers have been appearing in its journals. Among the numerous workers, of this period who have contributed substantially to the advancement of our knowledge of Indian insects, the names of Wood-Mason, de Niceville, Marshall, Atkinson, Aitken, Davidson, Bell, Bingham, Cameron, Wroughton, Rothney, Hampson, Distant, Cotes, Swinhoe, Watson and Moore are of outstanding importance. Thus, during the closing years of the past century workers on Indian Entomology increased considerably and the output of publications on the subject also became very appreciable. Among the important papers of this period, one by Rothney on "Indian ants" published in 1893 contains a very interesting record of how to his great surprise the author found reams of paper in the Stationery godowns of a Madras stationer, V. Perumal Chetty, free from white ant attack,

and how this was explained by the proprietor as being due to the existence of a small red ant which kept away the white ants. This is perhaps the earliest record of a biological method of insect pest control in India? By this time the Government of India, having been convinced of the need for reference works on Indian zoology, started the publication of the *Fauna of British India* and the first work in this series on insects appeared in 1892. This was Sir G. Hampson's monumental work on the 'Moths of India' in four volumes; next appeared Bingham's work on the Hymenoptera about 1897. In the wake of these, further volumes on other groups of insects have since followed. During the closing years of this period we had also separate monographic publications on Indian insects by such authors as Swinhoe, Cates, Moore, and Distant. In the year 1888 interest in the applied aspect of Entomology began to be evinced by the Government of India and at the suggestion of Sir Edward Buck, the then Revenue Secretary, the publication of periodical notes on Economic Entomology was started by the trustees of the Indian Museum, Calcutta. Mr. Cotes issued the first part of it. Between 1889 and 1903 this well known publication called the *Indian Museum Notes* appeared in five volumes; these volumes contain a mine of information on insects, especially those of economic importance and the credit for contributing to these valuable volumes goes to Cotes, Atkinson, de Niceville, Barlow, Alcock and Stebbing.

THIRD PERIOD (1900 ONWARDS)

The very first year of the present century marks another epoch in the history of Indian Entomology; for it was in 1901 that this science received formal official recognition and the first Entomologist to the Government of India was appointed in the person of Lionel de Niceville. Unfortunately he died before the end of the year and in 1903 Prof. Maxwell Lefroy was appointed to the post. He worked for some time at Surat and with the establishment of the Imperial Agricultural Research Institute at Pusa, in 1905, he was attached to this Institute as the first Imperial Entomologist. Prof. Lefroy, who worked in India for about a decade and under whom the writer had the privilege of getting his early training in Entomology, was a man of indomitable energy and enthusiasm for scientific work. He published two important works on Indian insects, and his monumental work, "Indian Insect Life" is well known all over the world. The progress of entomological work since Lefroy's days has been so rapid and many-sided that it will be impossible to give any satisfactory account of it in this paper. It might be stated that from this time onwards the economic aspect of Indian insects began to come into

great prominence. The work of agricultural, forest, veterinary and medical entomologists began to loom large in different parts of India, and numerous publications in the form of monographs, reports, bulletins, leaflets and even text-books began to be published. Provincial Governments and some Indian states started entomological work. Madras was the first among the provinces in this direction as may be found from the work of Bainbrigge Fletcher who was the first Madras Government Entomologist from 1909 up to 1911 and who published the book on " Some South Indian Insects " (1914). Other provinces followed and at present we have official entomologists in several provinces and states. The Mysore State has been very conspicuous in this direction since an Entomologist was appointed there in 1907 long before any of the British Provinces created such a post. The establishment of special institutions in different centres of the country for researches in forestry, veterinary, medical and industrial subjects added rapidly to the army of workers on insects and numerous papers appeared in new periodicals such as the *Indian Forest Records Journal of Indian Medical Research Memoirs and Bulletins of the Imperial Department of Agriculture*, etc. Among the many early workers of this period were Stebbing, Imms, Beeson, Alcock, Annandale, Howlett, Fletcher, Christophers, Stephens, James, Liston, Patton, Donovan, Leeshman and Cragg. The inauguration of the Zoological Survey of India, the old Natural History Section of the Indian Museum, in 1916, and the earlier starting of the *Records and Memoirs of the Indian Museum* gave further stimulus to entomological workers and several authors like Annandale, Brunnetti, gravely contributed the pages of these periodicals. Nor were the European planters of these days idle in this direction as might be seen from the excellent work on the *Pests and Blights of Tea* by Watt and Mann published as early as 1903 and the later contributions by Andrews and others. As regards faunistic literature, while we had only two works on insects in the Fauna of India series during the closing years of the past century, within the first decade of this century the number has increased to over thirty and we have now volumes on several important groups of Indian insects. The pages of the Bombay Natural History Society's Journal have also continued to include numerous entomological papers all these years; and of the many contributors to that journal during the first two decades of this period special mention may be made of Hampson, Cameron, Nurse, Meyrick, Bingham, Bell, Stebbing, Green, Giles, Wroughton, Young, Fraser, Evans, Ellis, Hingston and Hannyngton. It may be remarked in this connection, without casting aspersions on the work of

any official Entomologists, that the great bulk of the early work on Indian insects was accomplished by the numerous selfless workers who carried on entomological work, not as part of their official duties are to earn their bread, but merely as a hobby and as a result of their love for the science. This has been specially so in the case of planters, missionaries, forest, revenue and medical officers. It is the collections and observations of many of these early enthusiasts which have supplied the necessary material to specialists outside India for their many contributions to periodicals like the *Annals and Magazine of Natural History, Transactions and Proceediugs of the Entomological and Zoological Societies*, and many other journals of Europe.

Now that we have an army of official Government workers in the different provinces the bulk of the present day investigations are carried out by Government Officers and the results are being published in official periodicals of various departments. In view of the fact that the number of workers on the subject has considerably increased all over the country, it will be very difficult to do sufficient justice to the labours of all the workers in a short review of this nature. However, one would be certainly failing in his duty if he omitted to pay some tribute to the remarkable work of the sons of the soil towards the development of Entomology, since they have contributed not a little to the rapid and substantial progress of the science, especially during the past twenty years. However, until recently very few young and enthusiastic Indian workers occupied independent positions. One of the important problems of these men was not so much the difficulty of doing good work and writing papers worthy of publications in a decent periodical, as it was of carrying out the hard and delicate task of steering their productions successfully through many of the shoals an quicksands of administrative machinery. It is, however, satisfactory to note that the times are changing for the better and Indian workers are coming to the forefront and we have at the present day good many of them engaged in very important investigations producing highly creditable results and contributing substantial papers on Entomology to many scientific periodicals in and outside India. The writer feels that it will be a very delicate task to mark out the more prominent of the present day workers and feels that it would be better to leave the judgment to writers of a decade or two later. The progress of the science has been so rapid during the past few years, that even as early as 1919, some workers had begun to feel the need for an association and a journal solely devoted to Indian Entomology: but unfortunately nothing materialised in this direction for many years.

The starting of such a Society which was overdue for many years has now become an accomplished fact and we therefore cannot but welcome the advent of the new Society inauguarated for the purpose, and the journal its medium, and do our level best to help the laudable undertaking in all possible ways.

In conclusion, the writer ventures to hope that this brief survey of Entomology and its early devotees in India, with all its inevitable shortcomings, might not only be appropriate in the first number of the first Indian Journal of Entomology, but also give some insight into the labours of early workers in this field and act as a stimulus to rising young entomologists in India reminding them of the sentiments in the well known lines.

"Lives of great men all remind us
We can make our lives sublime,
And departing, leave behind us
Foot-prints in the sands of time."

(Indian Journal of Entomology Vol. 1, Parts 1 and 2).

GOAT KEEPING A PROFITABLE PURSUIT

Owners of goats to-day, though negligent of the feeding of their uncontrolled live-stock, however, wait anxiously for an ensuing festival season to dispose of their goats at a high price and get disappointed at the meagre profiit they earn, ignorant of the fact that their profit would have been higher if they had paid attention to the proper mating, milking and upkeep of their live-stock. Want of education accounts for this. Demonstrations by corporate bodies have proved the success of goat-rearing as a profitable pursuit and requiring only minimum cost, labour and maintenance.

India affords all facilities for goat-rearing even as a largescale concern. Goat-rearing exists on a small scale and it can be brought up to a better standard.

An ordinary goat can be purchased for an amount below seven rupees. The cost of feeding and housing of such a goat is very little.

A small shed covering an area of about 30 square feet attached to a side wall of a house would do well as a goat pen. The roof of the house may be extended downwards to cover the pen. The sides of the shed need not be covered up. Where jackals or other wild animals are feared the sides may be latticed. Care should be taken to tie the goat against the wall of the house to prevent cold or moist air affecting the face and chest directly. Hard beaten floor would be a comfortable bed. The pen should be so constructed that an extension could be made easily when

the goats increase in number. The cost of such a pen may never get beyond the means of the owner.

Feeding the Goat.—A domesticated goat very easily gets used to household food remnants. The natural tendency of a goat is to eat green leaves and grass in small quantities and that very frequently. Lest the garden or crops in the field should be eaten away by the goat it should be kept tethered. Where there is possibility for grazing, arrangements for taking the goats out, can be made individually or jointly. It is also practicable to provide them with necessary green food in a limited area. Fooder grass such as napier or guinea may be grown or bought and green leaves like banyan, jack or babool may be obtained by convenient arrangements. The green food which the goat eats should be given in plenty and should be provided for night also. To keep the food clean store it two feet above the floor.

The goat should also be fed with bengal gram, peas, jawary, cotton seed or ragi. These foods should be soaked in water for twelve hours at least before giving the goat. It is preferable to give not more than a handful of a mixture of these twice a day. Where it is not possible to get all these stuffs bengal gram alone may be given in the morning and cotton seed in the evening. This is very essential to a goat during its milking period. As with all animals, goats also have a thirst for water. Clean water alone should be given and that three times a day. A small quantity of salt not exceeding two ounces for a goat for a day should be added to the water both morning and evening. To this water may be added a small quantity of oil-cake.

The cost of feeding a goat in a house where plenty of green food and remnants of domestic food are available, will not go over a rupee and a half for a month. Even if all these are to be purchased, the cost would not go over 2½ or 3 rupees.

Most of the people who keep goats do not wash them at all. It is enough if the goat is washed once or twice a week. Every goat keeper must bear in mind that washing his goat is as important as feeding it.

Another important thing which a goat keeper must pay attention to is to exercise his goat. It must be taken out for a walk daily or made to run round the owner's dwelling house several times.

Careful Breeding.—Feeding and housing alone can neither make the goat rearing industry a complete one nor can it bring forth the desired result. To achieve this end every goat keeper must pay keen attention to the mating of it, where lies the keystone to success. Goats mature

at an early age. To have the best result they should not be allowed to mate before they are 18 months old. Even after that they should not be allowed to mate with any stray he-goat. He-goats of superior breed alone must be allowed to mate. The mating he-goat must be over 15 months old and be of good health, vigour and build. It must also belong to a good milch breed. Experiment and experience have found out that hornless white Surti breed fares well in Indian climate and that it has a good milking capacity. A goat of this breed maintained by the Y. M. C. A. Rural Centre, Martandam, yielded 78 ounces of milk after its two kids sucked to their contentment. In—breeding should be avoided as far as possible.

The best time for mating is when the goat is in its heat, the general sympatoms being temperature in the body, restlessness and white discharge from the uterus. Generally the heat in a goat lasts for about 18 hours. This is the proper period for covering. The heat re-occurs once in 15 days. A goat can be mated again two months after kidding. This does not affect the animal or its milk yield.

The period of gestation varies from 148 to 153 days. Special attention must be paid to the care of the mother goat. It must be given regular exercise, plenty of water, nourishing food and a warm place of rest.

After kidding, during the first 15 days, the kids may be allowed to suck as much milk as they require, and the mother goat must not be given concentrated food during the first week but fed with only light food such as rice or jawary kanji. After the 15th day the kids begin to eat tender leaves and grass, then the quantity of milk allowed to them may be decreased, and they can be weaned when they are three months old. The goat can be milked from the third day of kidding.

Careless feeding and watering may sometimes cause diarrhœa or constipation to a goat. A dose of 2 to 3 ounces of castor or gingelly oil in an empty stomach and laxative food for two days would bring about complete cure. If it happens to get cold, one ounce of pepper and a dozen betel leaves should be pounded together and administered to the sick animal twice a day. The aid of a veterinary doctor should be sought for when the goat meets accidents or gets seriously ill.

Nursing quality of milk.—The nourishing quality of goat's milk is undisputed. Before milking, remove the goat from the shed to a neat dry place and wash its teats with soap. Clean vessels must be used for milking. It is always advisable to filter goat's milk over a clean cloth before boiling to prevent hairs setting in, A child fed on goat's milk is

known to be healthier and stronger than a child fed on other milk. These are the reasons why goats' milk has acquired universal approbation.

In addition to the milk, the goat yields rich manure which is highly recommended for pot-plants and vegetable gardens.

Goats must be treated as pets. An ordinary family in India can rear up to five goats without strain, when all the members of the family co-operate in the task. The subsidiary income thus got from this brings fresh vigour to the growing children and gives them a cheerful face acquired from the extra nutrition contained in the goat's milk.

By taking in hand this cheap and simple industry of goat rearing, poverty can be eliminated from India and the problem of introduction of balanced diet can be solved. It is therefore ardently wished that every home should improve the existing goats and encourage the furtherance and betterment of the breed.—(*The Hindu.*)

AUL FARM

Agriculture in areas chronically subject to floods presents a difficult problem. In a Province like Orissa, where poverty is widespread and there is need for making the fullest use of all available land in order to provide sustenance for a teeming population, a solution of this problem is obviously urgent. From this point of view, the work done at the small experimental and demonstration farm at Aul, which is described in a bulletin issued by the Orissa Department of Development (Agriculture), is of considerable importance, and the results are very encouraging, notwithstanding that the farm is one of minute proportions, being only five acres in size. Aul is situated in the typical flooded area lying between the rivers Kharsua and Brahmini. The farm was opened in 1930 with a view to studying agricultural conditions in the area, some 50 squre miles in extent, within the Aul circuit embankment, of which over 23,000 acres are said to be well-suited for cultivating profitable *rabi* season crops. This part of the delta being still in formation, the introduction of new crops which would suit the peculiar conditions prevaling there has been specially studied and the results have already been utilised by those who own lands in the peripheral area from where the water recedes early. Since water does not as a rule quickly recede and the accumulated rain water stagnates for long, it was found that long-term crops like the finer varieties of paddy could not be successfully grown, but that *rabi* crops with and without irrigation could be profitably grown. Sugarcane, in particular, can be grown successfully as a dry crop as "as the deep root system taps moisture from the lower strata of the retentive soils and

establishes itself before the floods set in", provided the floods when they come, are not so heavy as to submerge the crop completely for weeks together. With some irrigation in the latter stages when the floods have subsided, heavy crops, it has been found, can be secured. Early sowing is equally effective in the case of oat, wheat, barley, gram and linseed. Sugarcane and onions are, however, the most profitable and it is suggested that there may be good scope for other deep-rooted crops also. The experience of Aul may be profitably utilised in areas in our own part of the country where similar conditions prevail.—*(The Hindu).*

FROM RESEARCH TO THE FARMER'S FIELD
IMPROVEMENTS TO BE TRIED OUT IN VILLAGES

Recommendations of I. C. A. R. Advisory Board.

These village projects of developmental research have for their object the trying out, according to a co-ordinated plan and in selected villages, of all the improvements that are recommended, based on the results obtained from scientific research.

The Board also recommended the immediate grant of Rs. 5,000 for investigations to test the possibilities of the production in India of certain drugs which are difficult to obtain owing to the war.

It will be recalled that the Governing Body had recommended the reconstitution of the various Committees which met under the auspices of the Council. At the present meeting, the Advisory Board took up this question and various Scientific and Commodity committees dealing with rice, wheat and cereals, pulses and millets, tobacco, fruit and fruit products milk and milk products, wool, poultry and eggs, hides and skins, fish, soil science, plant pathology, developmental research, animal breeding, nutrition, fodder and grazing, *etcetera*, were constituted.

The personnel in a majority of the cases has been limited to 10, and in a few instances to 12 members. This arrangement is likely to lead to better and speedier working. All the committees have been appointed for a period of three years.

Collaboration in Research.—With a view to effecting better collaboration in various research projects, it was recommended that the provincial Governments should provide facilities for research workers to tour other centres where work of a similar nature was in progress.

For the development of the fruit industry, the Board recommended unanimously that to meet present pressing needs in view of the demand for canned vegetables and dried fruits, the necessary staff should be appointed by the Imperial Council of Agricultural Research at an early date and the Governing Body should be moved to allot funds for the purpose as soon as possible.

This staff will carry out urgent experimental investigations, help in standardising fruit and vegetable products, introduce improved processes of manufacturing and help factories to produce articles which will be of standard quality and satisfy the requirements prescribed by the Army and Public Health authorities.

When the Advisory Board discussed the report of the Veterinary Investigation Officers working in all the provinces and an Hyderabad State, it was observed that havoc caused amongst Indian cattle by Tuberculosis and Johne's disease was assuming alarming proportions. The chief practical difficulty in tackling these diseases was the disposal of infected animals. Experts advised their destruction but this did not appear to the Board to be feasible in this country. It, therefore, recommended that suitable measures should be adopted for their segregation either directly by Government or at *pinjrapoles*, which might be subsidised for this purpose if necessary.

The Board also considered problems arising from the supply of milk from villages to towns and made certain concrete suggestions with a view to improving the supply, in the interests of both producers and consumers.

New animal husbandry schemes recommended include research into poultry diseases in Baroda and Gujerat, the introduction of general milk recording under the Travancore Government's scheme for the improvement of local cattle by grading them up with Sindhi, and the study of the Indian Institute of Science, Bangalore.

Improvement of wool.—The development of wool production and the improvement of sheep also came under review. It was observed that closer liaison between the producer and the industrialist was needed, so that it might be possible to evolve a type of wool which is in demand by the local traders. It was considered that the first essential was a survey of sheep in India and the definition of the characteristics of the different breeds, with a view to evaluating their potentialities as wool producers; thereafter work should be done with a view to obtaining uniformity within each breed and development should be attempted in accordance with the trade requirements in different parts of the country.

The establishment of a wool research station was also recommended and the Director of the Imperial Veterinary Research Institute was asked to draw up a detailed scheme.

Mr. Venkataraman, of Bombay University, was asked to submit a complementary scheme for the development of wool on the technological side.

Research Workers' Tenure.—The uncertainty of tenure under which the research staff of the Council is employed has been engaging the attention of the Board for the last couple of years. In order to improve conditions of service and provide some reasonable security of tenure to the staff appointed in the various Imperial Council of Agricultural Research schemes, the Board recommended that a suitable scheme be drawn up by the Secretariat of the Council to provide, if possible, for a permanent cadre of experienced research workers.

The Board also recommended that co-ordinated schemes be formulated on rice breeding for salt lands in coastal regions, Virginia tobacco, pulses and small millets.

In conjunction with the meeting of the Advisory Board the Conference of Horticultural Research Workers met to review work in progress on fruits and vegetables. The orchard management of five

fruits—mango, orange, apple, pineapple and papaya—was discussed in detail. The Conference recommended that work on the classification of these fruits should be undertaken forthwith and a tentative schedule of characters should be drawn up as a basis for work on mango in the first instance. It was also recommended that the Conference should be held in Delhi once in every two or three years.

Among new schemes recommended to the Governing Body are the production of Virginia tobacco seed at the Imperial Agricultural Research Institute, the breeding of ground-nuts in Mysore State, co-operative marketing experiments on cloves in Orissa, work on insect pests of *paddy* in Bengal and on storage pests of *jowar* at the Imperial Agricultural Research Institute, New Delhi, and four sub-stations to be located in in Madras, Punjab, the Central Provinces and Bihar; an investigation relating to the determination of the nutritive value of certain indigenous grasses and leafy fodders found in India, which is to be carried out at the Imperial Veterinary Research Institute at Izatnagar; and a scheme of research in minor or trace elements at the University of Calcutta.—*(Indian information Vol. 7, No. 64).*

College and Hostel Notes

The Janmastami and Ganesh festivals are the chief events of the period under report. These festivals were conducted with the guidance of the "Agriculture College Hostel Festival Committee. The celeberations commenced on the 26th August 1940 where Pandit Hrishikesh Sharma, Principal, R. B. A. Mandal, Wardha, delivered an illuminating address on the subject, "The message of Lord Krishna." Elocution competitions in English, Hindi and Marathi languages provided great encouragement to a number of students who are interested in oratory. The following students were adjudged to be the best speakers. Messrs D. N. Kherdekar English), W. R. Chauery (Hindi), M. K. Oka (Marathi). Professor D. K. Garde of the City College, Nagpur addressed the students on the "Ganesh Chaturthi" day, on the subject of "Settings of Democracy." During the programmes we were fortunate in having Swami Bhaskareswaranand of the Ramkrishna Ashram and many other prominent guests who kindly graced the occassion. Interest in dramatic performances is gradually waning in the Indian Society in recent times. Very few educational institutions are therefore found still continuing to play these performances. However our College shows a great promise of keeping the torch of the great art still burning. We have by now earned great reputation in this respect for the high order of performances that we have put up so far. This year we staged two dramas, "Neech" in Hindi and "Ghara Baher" in Marathi. The success of the Hindi drama is chiefly due to the able guidance of Messrs. R. N. Kayasth and M. A. Rahim who took considerable pains in training the various actors. The roles of Messrs. R. P. Jyotishi and L. N. Malviya were the most praiseworthy. The Marathi drama was a brilliant success in spite of the little time during which the preparations were made. Messrs P. M. Ingley and U. S. Ambedkar may be mentioned as the best actors. Mr. Sawalaram the famous blind musician, Mr. Patwardhan's band of young musicians, and Mr. Pise of Hislop College, Nagpur provided us with a feast of variety entertainments.

COLLEGE SPORTS

Practise in all the games was delayed this year owing to unfavourable weather at the commencement of the season. However later on very great activity on the fields became a remarkable feature of this year. The form of the Hockey and Football teams was of a very high order. But unfortunately some of our prominent players could not strike their best in the University tournaments owing to illness. We defeated the City College, Nagpur in Football in the first round and lost against the College of Science in the second round. Though we have very little success in matches yet we can boast of having played these games for their sake, victory or no victory. In this respect our thanks are due to the Sports Committee which has taken very keen interest in their duties, specially our Principal Mr. E. A. H. Churchill whose assistance has been a source of great encouragement to us.

Little Farmers

By T. P. Dubey

(Assistant Teacher, Hoshangabad).

(Song sung by the students of Agriculture School, Powarkheda on the occasion of the visit of H. E. the Governor).

We little Farmers, we have got lands
Crops we can grow well, even in the sands
With heavy iron ploughs, in the summer shining light
We have to cultivate, through and quite.

Till the land in time, and never after
That is the advice of, our head master
By ploughing the land, and adding manure
Bumper crops, heavy yield, profit is sure.

The crop rotation, one should forget not
By means of which, he ever gains a lot
The land is our all, and working it the goal
By means of which we feed, the world as a whole.

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Editorial

TENANCY REFORM IN THE CENTRAL PROVINCES
THE C. P. TENANCY (AMENDMENT) ACT XI OF 1940

Tenancy legislation in India is characterised by its multiplicity and complexity. There are usually a number of interests conflicting with each other in respect of the ownership, cultivation, or other rights in land and its appurtenances. This has called for a constant change in the tenancy legislation in different provinces. The tenancies in the Central Provinces have in no small measure escaped the necessity of this reshuffling. This is particularly noticed in the case of those tracts which are under the landlord tenure. Berar, which is under the Raitwari tenure, has enjoyed a comparative quietude owing to the simplicity of its tenure. The statutory creation of the landlord estates in C. P. by the conferment of proprietary powers on prominent land holders, for facilitating the collection of land revenue, has resulted in superimposing a class of landlords on cultivators whose rights in their holdings were of long standing. To prevent the degradation of such cultivators, protective tenancy legislation followed immediately. Fixity of tenure, fixity of rents, freedom to make improvements, etc. are the primary needs of the tenants and hence they were gradually attended to in accordance with their claims. The legislation that followed has thus endeavoured to create a hierarchy of tenants, by assigning to them different

rights and privileges of different degrees. The classification that is prevalent for the present is determined by the Tenancy Act of 1920, which is a comprehensive legislation and may be acclaimed to be a land-mark in the annals of the tenancy legislation in this province. This act divides the tenants into three classes, which are in respect of their privileges, Absolute Occupancy Tenants, Occupancy Tenants, and Sub-Tenants.

The above act was amended several times during the last ten years, but the recent amendment in the form of The C. P. Tenancy (Amendment) Act XI of 1940, which is to come in force from 1st May 1941 is an enactment of far reaching importance. It introduces momentous changes in the rights, privileges, and liabilities of the landlords and tenants. The object of this legislation is stated to be the great need of bringing the tenancy law in line with the progressive opinion in the province. It is pointed out that the tenants have become keenly alive to their rights and interests, and that there is an insistent demand for liberalisation of the law so as to bring it more into accord with the changed conditions. In doing this, it has been claimed that the Malguzar is not deprived of his just rights.

However, the passage of this bill to the statute book has not been very peaceful. As it is mainly sponsored for benefitting the tenant, it immediately fluttered the dove-cotes of the several landlords in the province, and a fierce controversy immediately followed. It was severely opposed as being detrimental principally to the landlords as it deprived them of their age-old rights and privileges, and being even *ultra vires* of the Provincial Legislature. Opinion with regard to the real benefit that is expected to be got by the tenants is also not unanimous. Thus this legislation has been a hot-bed of controversy. Leaving apart the knotty legal problems, the extent to which this act introduces changes in the status, rights and liabilities of the tenants and landlords alike, and their immediate and distant repercussions on the economic condition of the agriculturists, and the development of the

agricultural occupation in the landlord areas of this province, are matters of real concern to us. We, therefore, outline below the principal changes which the Act introduces in the existing tenancy law. Attempt has also been made to formulate the main principles which help us in evaluating these changes from the point of view of attaining agrarian welfare. The changing conditions are bringing to the forefront many such problems which were dormant so far. It is here that the intellengensia of the country have to deliberate and then formulate a well thought out and comprehensive policy which will establish our landed interests on a firm footing and thereby create for them a congenial atmosphere, which will be conducive in all respects to the attainment of our ultimate goal of an all-sided agricultural progress.

Absolute Occupancy Tenants.—The present Absolute Occupancy Tenant has a limited right of transfer of his holding. He can transfer any right in his holding to a co-tenant or to his immediate heir. He can mortgage his holding by a simple mortgage or a mortgage by conditional sale. If any other transfer is intended he is not free to make it. If he intends to transfer the holding to a stranger the landlord must be informed about it. The landlord has the right to purchase the holding at a price fixed by the Revenue Officer. Even if the tenant does not inform the landlord, and effects the transfer, the landlord can enforce his claim to purchase such land. If the landlord does not intend to purchase it himself he may permit the transfer on the receipt from the transferee consent-money to the extent of one year's rent of the holding. An Absolute Occupancy Tenant can sub-let his holding for a period of ten years.

The Amending Act extends the privilege of transfer in a number of ways. He may bequeath in his life time his interest in the holding to a co-tenant or his immediate heir. In the case of transfers intended to be made to strangers the Malguzar's right

of pre-emption prevails. At present in case the parties are disagreeing the Malguzar has to purchase the right at the price fixed by the Revenue Officer, but the Amending Act provides that he must purchase it for the same consideration which is agreed to be paid by the intending purchaser. But if the Malguzar does not intend to enforce this right of pre-emption, he may allow the transfer on accepting as consent-money either 3 per cent of the consideration in the case of transfer by sale, or one year's interest whichever is greater. This change regarding the price at which the Malguzar can purchase the holding and the consent-money to which he is entitled, is subjected to severe criticism on the ground that the tenants are likely to make the Malguzar's right of enforcing pre-emption quite ineffective by colluding with the intending purchasers and thereby keeping the consideration at a fictitious figure. However the law provides a check to this by linking up the consent-money to the consideration, whereby the consent-money to be paid to the landlord will increase in case the consideration is fraudulently increased. Even otherwise, the possibility of redress through Civil Court is also an indirect check. The period of sub-letting has been reduced to five years. This is in keeping with the general policy observed in the act of discouraging sub-letting.

Another very great change which has been introduced and which characterises this legislation as a very bold attempt to elevate the status of the tenants is, by empowering them to secure the Malik-Makbuza right in their holdings, on paying to the Malguzar, ten times the annual rent of the holding. The status of a Malik-Makbuza is most covetable. He is a proprietor of his holding and not the tenant of the landlord. He has an independent right in his holding similar to the occupant in the Raitwari areas who has no landlord between himself and the Government. The revenue payable by him is fixed by the Revenue Officer at each settlement. There is no chance of its increase until the new settlement. Thus he is free to make any improvement in his land and can have all the share of the increased profits to

himself. No one is entitled to demand a share in it by increasing the rent. The right of transfer is absolutely free. When a tenant thus gets himself declared as a Malik-Makbuza he will be immediately raised to a considerably higher level, as being a full and free owner of his land. This law has introduced the possibility of making such remarkable change in the status of the tenants with a view to making them more credit-worthy. At present the difficulty of getting finance for agricultural purposes is being keenly felt throughout India. This is because the agriculturists have little or no security to offer other than their lands. If the lands are not transferable it is hard to find a creditor. The newly created Malik-Makbuza will have a freely transferable right in his holding and hence the money-lender will easily provide him credit. This will facilitate a many sided improvement to be made in the lands and the methods of agriculture. However, there may be no hesitation in saying that such a facility will not be an unmixed blessing. It will be like any other power which if not wielded properly may recoil on the person himself. If the power to command more credit is utilised in obtaining money for agricultural purposes which will also help its repayment in the near future, the purpose of the law will be best served. But if the newly obtained power leads them to reckless borrowing, and utilising such money for unproductive purposes, the time will soon come when the Malik-Makbuza will have lost all his land. The lands will thus pass into the hands of a few money-lenders and the present tenants who are tied down to their lands will be severed from them and will be reduced to landless labourers. Full, free and absolute rights in land to the cultivators is an ideal tenancy which any agricultural country may hanker after. However in these days of excessive indebtedness of the agriculturists, with a number of anti-alienation laws already in the statute book, the creation of the facility of the transfer of land is an expedient which merits thorough examination. These fears may be partly allayed for the present owing to the expectation of a very small number of cultivators being able to

take the benefit of the change, as they will not be able to find the funds necessary to pay for the desired change in their status.

Occupancy Tenants.—The interest of an Occupancy Tenant passes on his death by inheritance according to his personal law. His heirs have therefore no interest in the property merely by virtue of their birth. They cannot demand a partition of the holding in the life time of the holder. The Amending Act confers on them the right of survivorship. This brings the Occupancy Tenant in line with the present Absolute Occupancy Tenant in respect of the devolution of the property. The effect of this provision will be that the holder of the property will be restricted from contracting debts for improper purposes, as he will have the fear of the heirs demanding an immediate partition. It is also true that this will facilitate an early sub-division of the holdings, which is undesirable.

The right of transfer in favour of other persons enjoyed so far by the Occupancy Tenant was extremely limited. If he intended to transfer the holding he was required to surrender it, in the first place to the landlord, who would then on accepting some consent-money transfer it to the intending purchaser. The payment of the consent-money was a great impediment to a transfer as there was no limit set to this by the law. The Amending Act provides for a comparatively easy method of transfer, whereby the landlord is compelled to purchase the holding, if he likes, at a price which others are prepared to offer. If he does not like to enforce this right of purchase, he has to allow the transfer to others on getting the consent-money. The consent-money to which he is entitled in cases of transfer by sale with or without his knowledge is according to the Amending Act 5% of the consideration, or one and half times the annual rent of the holding, whichever is greater. This will have the same effect as in the case of the Absolute Occupancy Tenants.

One of the greatest changes made by the Amending Act, which is intended principally to benefit the tenants, is the

elimination of the expedient of ejectment of the Occupancy Tenants in case of non-payment of rent. The present law authorises the landlord to get the tenant ejected through a Revenue Officer if all the rent due to him were not paid. With such ejectment all the rent dues are deemed to be satisfied. Ejectment means the complete severance of the tenant from the land in respect of which rent is due. This has resulted, in some cases, in extensive lands being lost by the defaulting tenants in lieu of very small arrears of rent. The Amending Act provides that a decree for satisfaction of arrears may be executed by the sale of the respective lands. This will now mean that all the land need not pass out of the hands of the tenant but that he will be deprived of only such area, which when sold, will satisfy the decree for arrears. At present the great difficulty in the transfer of the occupancy land always came in the way of the tenant intending to raise the money to pay his arrears of rent.

The right to sub-let enjoyed by the Occupancy Tenant at present is restricted to one agricultural year only. This has been extended to five years. It is difficult to understand the special intention of increasing this period of sub-letting in this case alone, when otherwise throughout the Act, sub-letting is discouraged. It appears however that this might aim at raising the status of the Occupancy Tenant by giving him this privilege along with other privileges which bring him nearer to the present status of the Absolute Occupancy Tenant.

The right to get himself declared a Malik-Makbuza is also conferred on the Occupancy Tenant on a payment to the landlord twelve and half times the rent of the holding. This will have the same effect as in the case of the Absolute Occupancy Tenant, and it may be presumed that the effect will be more pronounced in this case due to the extremely limited power of transfer being enjoyed by him for the present.

Viewing these provisions as they affect the tenure of the landlord it may be said that the turning of a tenant of a landlord

into a Malik-Makbuza i. e. a plot proprietor fundamentally affects the landlord. The landlord's propriety right in the holding is extinguished and subsequently it is created in favour of the tenant. However this is done in lieu of consideration which is payable by the tenant.

Sub-tenants.—There is no provision in the present law regarding the devolution of the sub-tenancy rights. The new act provides that such rights shall pass by inheritance or survivorship, subject to the terms of the contract.

The principle of discouraging large-scale sub-letting has always been widely accepted, it being in the long run detrimental both to the lessors and the lessees. If the lessors get into the habit of sub-letting the holdings and do not take any active interest in carrying out the work of cultivation, the necessary improvements in land are not carried out from time to time. The lessee having no permanent interest in the land exhausts it in as many ways as possible. Thus an idlers class is created which tends to live on the profits of agriculture without exerting in any way on land, and is instrumental in degrading the land. The lessee is generally required to pay the maximum rent possible, and hence he is hardly left with a bare maintenance as a reward for his season's labour. As there is always a very large number of landless labourers in villages who have no employment other than on land they compete with each other, and consequently rents become too much exacting. It is for this purpose that in certain selected areas the sub-tenants are granted occupancy rights in the lands which are usually sub-let to them. But the purpose of this law is easily defeated by transferring the sub-tenant from land to land and taking such land alternately for home cultivation. The Amending Act introduces very stringent provisions whereby habitual sub-letting will be very much controlled. It provides that land may be presumed to be habitually sub-let, if it is sub-let for a total period exceeding seven

years, during any consecutive period of ten years. A Revenue Officer is empowered to declare the sub-tenant *suo motu* as an Occupancy Tenant and fix his rent. Moreover, the lessor is not entitled to have the difference between the rent already assessed and the newly fixed rent. These provisions will thus check sub-letting. Another problem which arises in this connection is that if sub-tenancy were to be discouraged it may deprive the sub-tenant of his means of livelihood. But such a fear is not so great as it appears. When the owners begin to cultivate the lands themselves, they will have to employ all the labour that is required for this purpose from such classes. If they begin to take keen interest it will create still greater employment. Absentee landlordism which is a bane of our agriculture, particularly in prosperous times will receive a complete set-back.

Ex-proprietors.—The landlords generally hold some land which is termed as "Sir." The right of transferring such land is extremely limited as a transfer cannot be made without obtaining a special sanction of the Government. If the Malguzari assets are sold out, the ex-proprietor becomes an Occupancy Tenant of his "Sir" land. Permission to transfer the "Sir" land is granted only when it is found to be to the benefit of the proprietor. This anti-alienation provision has been made with a view to keeping at least some land with the ex-proprietor for earning his livelihood. The Amending Act eliminates these provisions and allows the "Sir" land to be transferred voluntarily or in execution of a decree. This is in keeping with the general tone of this act of granting free rights of transfer.

Original Articles

FRUIT MARKETING IN THE C. P.

By Mr. R. N. Gadre, L. Ag.

(*Assistant Marketing Officer*)

Introduction.—One of the most profitable and at the same time most enjoyable forms of agriculture is to be found in the cultivation of fruit trees. Till the beginning of this era, fruit cultivation was generally practised by the rich and fruit was considered a luxury. Commercial fruit growing on a large scale is of comparatively recent date. It has been made possible by three main factors:—The rise of large cities, the introduction of cheap and rapid transportation, the low yield of the staple crops and the general depression in prices. A considerable expansion of the fruit business of the world can be traced directly to the fact that as a result of the recent research, fruits are now recognised as an essential part of the human diet. Large scale advertising to stimulate the per capita consumption of fruit has also given a good impetus to the cultivation of fruit.

The Central Provinces are eminently suitable, climatically and geographically, for the extensive production of many kinds of fruits. The province enjoys a central position in the country and is nearly equidistant from all the big cities in India. The province is well tapped by an efficient system of railways, linking the different fruit growing tracts of the province with the important markets. Similarly there are in the province tracts with high and low rainfall, with different altitudes and also places enjoying moist and dry climate. There is much variation in the constituents of the soil of different parts of the province.

The factors which determine the successful and economic fruit cultivation are :—

(1) Selection of land and place for a particular fruit.

(2) Capital.—In general fruit cultivation requires more capital as compared to the ordinary farming. More money is required for the purchase of grafts and plants of fruit trees like oranges, mangoes, etc. As the cultivator begins to obtain a return on his planting after 5 or 6 years, this enterprise can only be undertaken by one who can invest the necessary capital on cultivating other crops to support himself and his family until his orchard comes into full bearing.

(3) Demand for the fruit.—The demand for fruit is increasing and it is expected that in the near future fruit will be included as a necessary part of the diet. Mere propaganda 'to eat more fruits' will not be enough; an increase in the purchasing capacity of a *kisan* would go a long way towards increasing the per capita consumption of fruit in the Province.

(4) MARKETING.—Fruit being a perishable article cannot be stored under ordinary atmospheric conditions for a long time ; so unless cold storage is provided it must be sold as quickly as possible after harvest. The success of a fruit garden depends as much on economical production as on successful marketing.

Acreage and trend of production.—Important fruits grown in the Province are mango, oranges, guava, banana and custard apple. Although the mango occupies the highest area amongst the fruit plants, it is not commercially an important crop, for the simple reason that the quality of the fruit is not so good as to create a demand in the important markets of the country. Moreover the area is so scattered that it is difficult to assemble the fruit in quantity at any one place for the purpose of marketing. The same is the case with the custard apple. Oranges, guavas and bananas are important fruits of the Province from the point of view of export. Their areas are concentrated and it is therefore possible to export the fruit to the chief Indian markets in large quantities. As about 62 per cent of the area under orange is concentrated in the Nagpur District alone, it has been possible to establish four wholesale markets for the fruits, viz., Nagpur, Katol, Kohli and Pandhurna. With the increase in the orange trade there has been an increase in area under this fruit, the increase amounting to as much as 175 per cent in the last 11 years.

The area under different fruit crops during the year 1939-40 was as follows :—

S. No.	Name of fruit	Areas in acres in C. P. & Berar	% of the total area	
			Under fruits and vegetables	Cultivated in the Province
1	Mango	38,294	25.98	0.15
2	Oranges	21,878	14.84	0.09
3	Guavas	10,089	6.84	0.04
4	Bananas	2,470	1.67	0.01
5	Custard apples	1,315	0.89	0.005

The area under fruit has steadily increased during the last ten years. There has been a marked increase in area under some fruits, chiefly due to the successful production and marketing of that particular kind of fruit. The trend in area under different fruit crops is given below :—

(In acres)

Year	Mango	Oranges	Guava	Banana
1930—31	...	8,432	6,228	1,646
1931—32	30,448	8,913	6,460	1,686
1932—33	30,511	9,257	6,683	2,067
1933—34	31,076	10,417	7,178	2,729
1934—35	34,203	12,346	8,064	2,442
1935—36	36,670	13,799	8,029	2,817
1936—37	36,491	15,239	8,345	2,064
1937—38	37,966	18,011	8,363	2,627
1938—39	38,891	20,219	9,822	2,538
1939—40	38,294	21,878	10,089	2,470

It will be seen that the area under oranges has increased enormously and it is feared that its cultivation may become uneconomical unless very definite steps are taken to improve the quality and to deal with the unmarketable surplus. The per capita consumption of this Province, which boasts of supplying oranges to all parts of India is itself very low as compared with the other countries of the world as shown below :—

Name of the Country	Annual consumption per head
U. S. A.	18.1 lbs.
United Kingdom	18.1 „
C. P. & Berar	2.3 „

Name of fruit	Total provincial supplies	Total imports	Total supplies (Col. 2+3)	Total exports	Net available supplies (Col. 4—5)	Annual per capita consumption of C. P.
						lbs.
Mango in maunds ...	3,142,575	78,000	3,220,575	2,000	3,218,575	16.7
% of the total supplies ...	97.6	2.4	100.0	0.1	99.9	
Oranges in maunds ...	1,500,000	4,000	1,504,000	1,060,000	444,000	2.3
% of the total supplies ...	99.7	0.3	100.0	70.5	29.5	
Banana in maunds ...	820,000	22,000	842,000	5,000	837,000	4.5
% of the total supplies ...	97.4	2.6	100.0	0.6	99.4	
Guava in maunds ...	1,600,000		NOT AVAILABLE			

Supply available, imports and exports of important fruits.—The table above gives the home-grown supplies, imports, total supplies, exports and net available supplies of the four important fruits of the Province. Figures given for each fruit in the table are not for the same period but they may be taken to represent the correct position of each kind of fruit with regard to the export trade.

It will be seen that the orange is the only fruit which is of great commercial importance to the Province. It can also be seen that there is great scope for the expansion of the area under such varieties of mangoes and bananas as are in demand in adjoining Provinces. The area under oranges could be safely increased as the per capita consumption of this fruit is very low as compared to other fruits in the Province.

Preparation for market.—Enquiries made during the course of survey show that about 80 to 90 per cent of the growers sell their standing crop to contractors and the rest, 10 to 20 per cent, market it after harvest. There are various reasons which induce growers to sell their standing crop. The chief of which are:—

(*a*) The majority of the garden owners are agriculturists, who have other cultivation work to attend to. Picking, packing and marketing of fruits require much labour and constant attention. This busy period coincides with the busy period in agriculture and so they prefer to sell the standing crop.

(*b*) The second reason is the ever urgent need of cash and the cultivators impatience to wait till the crop matures. *Beparis* generally go round to buy the crops and in most cases the money is offered at a time when the cultivator is hard-pressed for cash to meet the agricultural and other expenses. Under present conditions, the cultivator finds it difficult to borrow money without any security (mostly valuables), which he has seldom got to offer. With these considerations he sells the standing crop to the contractor.

(*c*) The third reason is the uncertainty of the season and the risks involved in waiting for the crop to ripen. A strong gale, insect attack, hail storms or a cold spell may cause considerable havoc to the fruit plantation and as some of these occur almost annually, the grower sells his standing crop for what it will fetch, preferring the certainty of "half the loaf" to a "full loaf," or no loaf at all.

(*d*) The cultivators are somewhat shy of the markets, since they know not what charges may be demanded of them.

Generally, hired professional pickers are engaged for picking fruit. Bananas being in bunches are easy to harvest. In the case of fruit trees, lower fruits are picked by hand and the higher fruits by different methods depending upon the kind of fruit; for oranges bamboo ladders are used and the pickers use baskets into which they fill the fruit. To pick the higher mango fruit, a net bag about 15" deep, fixed to an iron ring of about 12" diameter and bound to a long high pole and having two iron blades fixed on the ring is used. The iron blades cut the stalk and the fruit falls into the net. In case of guavas the one or the other method is used depending on the size of the tree. Bananas and mangoes are picked some time before they are ripe and are subject to a process of ripening, before they are ready for market. But the orange and guava fruits are picked when they are almost ripe.

From the garden to the assembling centres fruits are transported in bulk in bullock-carts. The motor bus is also sometimes used and is gaining in popularity where the roads are good. At the assembling market the fruit is usually packed by the exporters into baskets.

The question of containers in which the fruits are packed is also of importance. Most of the containers used for different fruits, have been in use for a long time and no serious attempt seems to have been made to design better types more suitable for the export of different kinds of fruits.

The practice or rather the malpractice of "topping" in packing is very common in the fruit trade. This has been universally condemned by the merchants at the terminal market, but if these merchants are required to pack fruit, they will also adopt the same system. The mixing of inferior fruit with those of superior quality in the same container depreciates the value of the latter. A considerable saving in packing, freight, commission, etc., could be effected if culls were utilized locally for the manufacture of marmalades and beverages.

Grading and standardisation.—Producers could get much higher prices by selling their produce direct in the local wholesale market, than by selling their standing crops to contractors. It is necessary to collect information about arrivals, stocks and prices of different kinds and varieties of fruits in the important consuming and distributing markets and to pass this information on to the producing areas. The practical difficulty about collecting this sort of information is the want of uniformity in the quality of fruit throughout the country. To overcome this difficulty it is necessary to adopt all-India standard grades as specified under the Agricultural Produce (Grading and Marketing) Act, 1937. Grading provides a basis for price quotation and for a general system of

sale. This is of particular importance in the case of a perishable commodity like fruit. The system of grading is advantageous in so far as it promotes mutual confidence between the seller and the buyer. The general adoption of " Agmark " grades would be in the interest of producers and the trade generally. Graded fruits are sold at a premium and this is enough to show that the desired object can be achieved.

Storage.—There are no facilities for the cold storage of fruit in the producing centre. The crop is harvested as soon as it is ready for market and is sold from day to day at the price offered by the merchant. The daily arrivals in the market vary and these irregular supplies give rise to fluctuations in price. There is, therefore, much need for convenient cold storage facilities in the producing areas, to enable distribution to be spread over a greater period. Recent researches carried out on cold storage are very encouraging and show that oranges can be successfully stored for a period of three months.

Transportation.—Fruits are brought from the orchards to the assembling markets or railway station usually in head-loads, bullock-carts or occasionally in motor lorries. The mode of conveyance depends upon the quantity transported, distance and kind of road. Wherever transport of fruits by motor lorries is possible this means is becoming very popular as it effects a considerable saving of time and labour and in many cases it is actually cheaper than transport by rail.

Railways have given special concession rates for wagon loads only. This does not help in the wider distribution of fruit as only a limited number of big consuming centres can take advantage of this. As the small consuming centres do not consume a wagon load, they have to depend upon their supplies on re-export from the main distributing markets. It is for the consideration of the railways whether it would not be possible to give concessions in freight for fruits despatched as smalls or re-exported to the neighbouring consuming markets.

Cold storage vans are provided by the N W. R. only but the number is negligible in view of the demand On other railways steel goods-vans are utilized for carrying fruits. These goods-vans which are not even provided with shelves are altogether unsuitable for transport of fruits, particularly in the hot weather.

From the study of the price-spread in the case of fruits, it will be seen that the share of the railway in the consumer's rupee varies from 8 to 35 per cent, depending upon the distance of the consuming markets from the producing centres.

Distribution.—In case of all agricultural produce and specially with a perishable commodity like fruits, distribution is the most important stage in their marketing. After leaving the orchard and before reaching the consumers, the fruit has to pass through several agencies. The diagram facing this page illustrates the general movement of the fruit from the producer to the consumers.

The commission agent is the pivot of the whole system of fruit distribution. In order to extend the volume of his business, he in most cases gives financial help to contractors who generally purchase standing crops. It is then obligatory on the part of these contractors to sell their produce through him alone. As about 80 to 90 per cent of the growers sell their standing crops to contractors, the range of competition amongst the buyers is very narrow and this ultimately affects the producer's prices. This evil could be avoided by organising Co-operative Growers Societies which could give short-term loans to the members on the security of their standing crop on condition that the produce will be sold only through the association. Unless the association has some power to punish those members who refuse to sell their produce through it, to enable the association to recover its loans, the scheme will not work satisfactorily.

There are no special markets for fruits except the four orange markets already mentioned. Generally fruits and vegetables of all kinds are sold in the same market. All important markets are under the control of Municipal Committees.

There are only two wholesale markets in the Province. These markets are situated at Nagpur and Katol and deal in citrus fruits, mainly oranges. Both these markets are as a rule very dirty and untidy. The unfortunate feature of these markets is the absence of sheds to afford protection to fruits from the sun and rain and proper space for displaying fruits for sale. Matters such as lay-out, lighting, water, sanitation, etc., are altogether neglected by the municipalities.

It is unfortunate that these two important markets should have been allowed to run as best as they could without any control at all from the municipal authorities, although they have a special staff for inspecting them. There are rules for inspection and for regulating the markets, but no effort has been made to enforce the bye-laws or to stop the malpractices. It is clear that the municipal committees have failed to administer the orange markets efficiently. In order that proper control may be exercised in the markets and practices

and prices standardised, it is desirable to establish these markets under the Agricultural Produce Markets Act, 1935.

The methods of sale in vogue in different markets are by open auction and by private negotiations. Each method has its advantages and disadvantages but in an organised market the first method is better. In the wholesale market the seller has to pay certain charges for services rendered by different agencies, some of which are unnessary. These charges are not uniform and vary from market to market and in some cases with each *dalal.* The market charges payable by seller as laid down in bye-laws of each orange market and the actual amount collected from the seller is as follows :—

(The charges are per cart.)

Particulars	Nagpur market		Katol market	
	As per bye-law	Actually collected	As per bye-law	Actually collected
	Rs. as ps.	Rs. as. ps.	Rs. as. ps.	Rs. as. ps.
Market tax	0 8 0	0 8 0	0 4 0	0 4 0
Dalali	0 5 0	1 4 0	0 2 0	1 4 0
Unloading the cart	...	0 1 0	...	0 1 0
Heaping	...	0 6 0	...	0 4 0
Dharmadaya	...	...	...	0 0 6
Total ...	0 13 0	2 3 0	0 6 0	1 13 6

In addition to the cash amount the *dalal* gets some of the best fruit known as *khadi.* These charges are irrespective of the value realised and when the price is low they amount to as much as 15 to 18 per cent of the total sale proceeds.

From the orchard the fruits pass through several agencies before they actually reach the consumer and these various agencies engaged in the distribution have their share in the price paid by the consumer. The share taken by some of the agencies is not in proportion to the amount of service rendered by them. The assembling and distribution costs and the proportion of the consumer's rupee retained by the various agencies in different fruits are as follows :

S. No.	Particulars	Percentage of the share in case of				
		Oranges			Mango	Banana
		A *	B *	C *	D *	E *
1	Price paid by consumer ...	100.0	100.0	100.0	100.00	100.00
2	Retailer's profit ...	7.7	7.7	9.1	12.50	11.11
3	Commission charged by agent ...	5.5	5.5	5.7	...	...
4	His market expenses ...	7.1	7.1	3.8	7.64	4.20
5	Railway freight or transport charges...	34.7	34.7	32.6	16 67	8.50
6	Packing and other charges ...	7.0	7.0	10.2	...	2 11
7	Commission charged ...	3.2	3.2	2.0	...	2.10
8	Wholesaler's profit ...	3 7	3.7	...	7 63	14.80
9	Market expenses ...	4.8	4.8	4.8	3 13	3.47
10	Contractor's profit ...	7.1	...	...	10 76	11.41
11	Amount paid to grower ...	19.2	26.3	31.8	41.67	42.30

* A.—A grower who sold his garden to a contractor and the fruits were ultimately sold in Lahore market.

* B.—A grower who sold his produce in Nagpur market and the fruits were ultimately sold in Lahore.

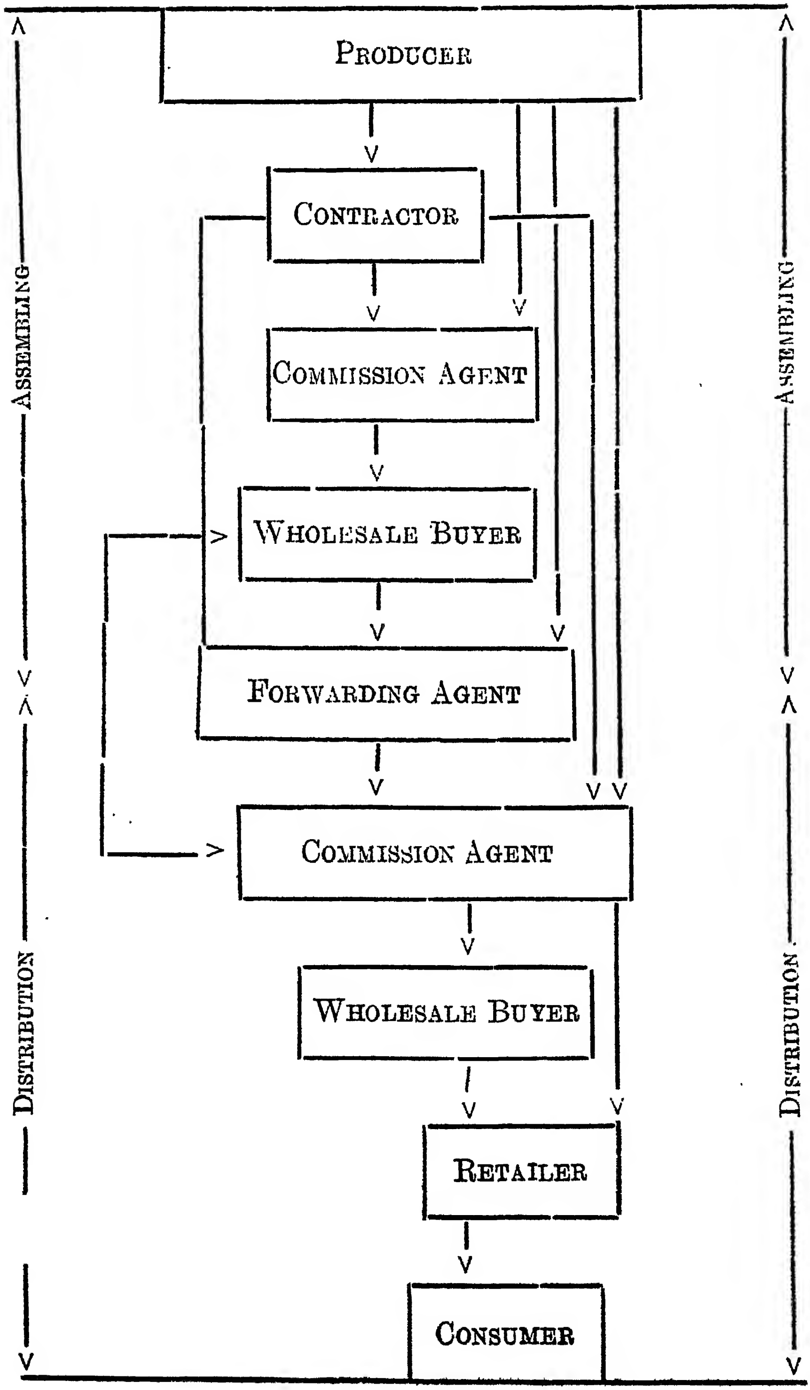
* C.—A grower who sold his fruits in Delhi market through the Orange Growers Association.

* D.—A grower in Katol who sold his mango crop to a contractor and the fruits were ultimately sold in Nagpur market.

* E.—A grower in Ramtek tahsil (Kodamendi) sold his crop to a contractor and the fruits were sold in Nagpur market.

From the distribution of consumer's rupee shown above it will be seen that the share of the grower varied from 19 per cent in the case of Katol oranges sold at Lahore to 42 per cent in case of Kodamendi bananas sold at Nagpur. The wide variation is mainly due to the distance of the consuming markets from the centres of production. The variation in the shares received by the orange grower in the three methods of sale is mainly due to the saving of contractor's or wholesaler's profit.

Channels of Assembling and Distribution of fruits



FERTILIZER TRIALS ON THE CHILLIE CROP

By Dr. R. J. Kalamkar, N. N. Bhide, and Mr. G. R. Shembekar,
(Northern Circle, Jubbulpore)

Introduction.—Chillies form a necessary part in the daily Indian diet of rich and poor alike. They are used both in green condition as well as dry. Being a ready cash crop, its value to the agriculturist is very great.

Chillies, as a rule, are grown during the rains but if facilities for irrigation are available, they can be grown all the year round.

No reliable statistics are available for the area under the crop for the different districts of the province but it can be said that Nagpur, Amraoti, Buldhana, Betul, Akola and Drug are the principal districts where they are mostly grown.

Fertilizer trial—Response of the chillie crop to the application of fertilizers is being studied on the Government agricultural experimental stations, Powarkhera, Hoshangabad.

The experiment is of a Latin Square type with four treatments on 1/40th acre plots. The experiment was started in the year 1933-34 and has been running for the last seven years. The site of the experiment together with the treatment which a particular plot is receiving since the start is fixed.

The soil is classified as Moround II. It is well drained and hence suitable for raising irrigated crops. The usual system is to transplant chillies during the monsoon, the distance between rows being 2 ft. and between plants in the same row being 1½ ft. Irrigations are given whenever necessary. The number of irrigations given, during the period under investigation has varied from 4 to 7 depending upon the kind of season.

A basal dressing of8 tons of well rotted Farmyard manure per acre is added every year to all the plots by the end of May or the early part of June. The fertilizers are applied in two equal doses, the first being applied a fortnight after transplanting and the second a month later. The transplanting is usually done during the first or second week of July.

The treatments consist of the following :—

(1) Basal dressing of Farmyard manure at 8 tons per acre only.

			Ammonium Sulphate		*Super phosphate*		*Potassium Sulph.*
(2)	Basal dressing	+	180 lbs.	+	370 lbs.	+	150 lbs. p. a.
(3)	„	+	230 „	+	480 „	+	190 „
(4)	„	+	280 „	+	585 „	+	235 „

The percentage of Nitroyes in F. Y. M. varied from 0.7 to 1.2 during the period. The percentage of P_2O_5 in super varied from 18 to 20, potash in potassium sulphate about 48 per cent and Nitrogen in all was about 20.61

Rainfall conditions.—Fortnightly rainfall together with the number of rainy days for the seven years of the experiment is given in Table I below.

TABLE I

Month	Fortnight	1933-34		1934-35		1935-36		1936-37		1937-38		1938-39		1939-40	
		Rainfall in Inches	No. of rainy days	Rainfall in Inches	No. of rainy days	Rainfall in Inches	No. of rainy days	Rainfall in Inches	No. of rainy days	Rainfall in Inches	No. of rainy days	Rainfall in Inches	No. of rainy days	Rainfall in Inches	No. of rainy days
April ...	I	0.05	2	...	...	0.13	1	...	...	...	...	0.03	1	...	...
	II	...	...	...	...	0.18	2	...	...	0.39	1	...	...	...	...
May ...	I	0.11	3	...	...	0.17	1	...	...	...	...	0.03	1	...	...
	II	3 02	5	...	...	...	...	0.91	4	0.08	1	0.44	2	...	...
June ...	I	0.73	2	0.89	5	...	...	...	...	...	...	6.81	11	0.58	3
	II	4.76	9	4.16	10	3.00	6	4.05	9	13.55	10	6.24	11	2.61	4
July ...	I	2.29	3	6.45	13	4.03	10	3.26	7	10.84	8	8.68	11	13.25	11
	II	11.47	11	6.00	11	23.02	14	4.26	6	10.45	13	11.59	15	5.42	11
August ...	I	24.07	10	12.75	15	17.95	15	10.94	8	1.79	9	5.94	9	2.74	2
	II	3.15	7	12.29	12	1.92	7	4.89	10	4.18	11	11.60	11	18.53	15
September ...	I	1.14	4	20.10	13	9.08	11	9.69	10	8.26	8	0.99	5	4 00	10
	II	7.72	9	9.79	9	5.14	7	1.19	2	1.86	2	0.06	1	1.85	3
October ...	I	0.95	1	0.20	1	...	...	...	...	1.72	3	3.50	5	...	...
	II	0.83	3	...	...	0.40	1	...	...	0.24	2	...	...	...	...
November ...	I	...	...	1.24	2	0.03	1	6.69	4	...	...	...	...	...	...
	II	0.15	1	...	...	...	...	0.15	2	...	...	...	...	...	...
December ...	I	...	...	...	...	0.12	1	...	...	...	...	...	...	0.12	1
	II	0.37	2	0.41	1	...	...	0.06	1	...	...	...	...	...	...
January ...	I	0.06	1	0.14	1	...	...	...	...	0.19	1	...	...	...	...
	II	...	...	0.70	1	...	...	...	...	0.47	2	0.36	3	0.12	2
February ...	I	...	...	...	...	0.48	3	0.35	1	...	...	...	...	0.03	1
	II	...	...	...	...	0.22	2	0.11	1	...	...	...	...	...	...
March ...	I	0.10	1	...	...	0.86	1	...	...	...	...	...	...	...	...
	II	...	...	0.01	1	0.24	2	0.26	1	...	...	0.33	2	...	...
Total...		60.97	74	75.13	95	66.97	85	46.81	66	54.02	71	56.60	88	49.25	63

Well distributed rainfall with favourable breaks allowing interculture operations in the rainy season are very essential for the successful cultivation of the chillie crop. Continuous rainfall or a very long break tells adversely on the yield of chillies. This is clearly brought out from the poor yields in 1934-35 when there was a continuous wet weather for nearly one and half months and in 1939-40 when there was a long break. In 1939-40 there was also an occurence of cold waves which further damaged the crop.

Statistical Analysis of the data.—The analysis of Variance of yield data for the individual years is shown in Table II and for the period of seven years is shown in Table III. The mean yield of the treatment is shown in table IV.

TABLE II

Analysis of Variance of Yield for individual years

Due to	D. F.	Mean square						
		1933-34	1934-35	1935-36	1936-37	1937-38	1938-39	1939-40
Rows	3	75 73	31.75	8.64	85 39	216.45	214.64	30.28
Columns	3	2 39	18.75	10.22	70.73	43.75	13.81	15.28
Treatments	3	314.39	45.08	56.81	98.73	268.54	249.06	69.67
Error	6	30.98	3.50	0.70	28.48	5.83	24.76	4.81

F. for treatment. $n_1 = 3$ 5% 4.76
$n_2 = 6$ F. 1% 9.78

TABLE III

Analysis of Yield. Seasonal Effect

Due to	D. F.	Mean Square	F.	5%F.	1% F.
Rows	3	236.76			
Columns	3	28.66			
Treatments	3	915.93	26.53	4.76	9.78
Seasons	6	1961.06	56.81	4.28	8.47
Residual Error (a)	6	34.52			
Interaction Rows x Seasons	18	71.02			
,, Columns x Seasons	18	24.38			
,, Treatment x Seasons	18	31.06	2.88	1. 91	2.50
Interaction Season x Residual Error(b)	36	10.76			
Total	111				

As already observed, the layout of the experiment is of Latin Square type and the experiment was conducted on the same plots over a period of investigation. The analysis of variance for individual years shows that the variation due to rows is greater compared to the error and is significant in five years out of seven and that in general there is greater variability along the rows than along the columns.

In the analysis of variance applied to seasonal effects in table III two estimates of error are involved. The first error denoted as error (a) is essentially an average, over the seven seasons, of random errors due largely to soil heterogeneity and serves as a basis for comparing the effects of seasons and treatments. It will be observed that over a series of seven years variation due to rows is significant.

The second estimate of error denoted as error (b) comes from the interaction of seasons with the residual i. e., error (a) and represents the interaction effects not accounted for by the interaction of seasons with rows, columns and treatments. It is therefore a random effect and furnishes a proper basis for an estimate of error for comparing the remaining interactions. All the interactions are significant, meaning that yields within the rows and columns changed from season to season in a manner which cannot be considered purely random and that there is differential response of treatments to season.

It will be observed from table II that the mean square due to treatments with 3 D. F. is considerably larger than the error mean square with 6 D. F in all the individual years except 1936-37 and is significant, indicating that the treatment effect is significant. The same fact is brought out clearly by analysing the data over a period of seven years, as is seen from table III. Interaction of seasons with treatments is also noticeable indicating that there is a differential response of treatments to season; apart from the straight seasonal effect which is highly significant. The effect of seasons is much more marked due to the fact that the crop was seriously adversely affected in the season 1934-35 because of continuous wet weather and in 1939-40 due to long breaks in the rain and incidence of cold waves in winter. It may be observed that the mean square due to error varies widely in certain seasons.

Response to fertilizers.—The mean yield in lbs. per acre of dry chillies for individual years as well as over a period of seven years is shown in table IV for each of the treatments.

TABLE IV

Yield of dry chillies in lbs. per acre

Treatments	33-34	34-35	35-36	36-37	37-38	38-39	39-40	Average
(1)	1400	452	735	950	665	950	477	841
(2)	1952	632	950	1250	1250	1350	570	1183
(3)	2072	760	985	1420	1260	1605	820	1317
(4)	2212	700	1095	1290	1405	1630	788	1349
Mean	1975	635	941	1228	1145	1384	664	1129
S. E. per acre	111.31	37.42	16.8	106.7	48.3	99.5	43.5	44.4

From the above table it is clear that increased yields over the control plot are secured by the application of fertilizers. On the average of seven years, treatment 3 has given significantly higher yield over treatment 2. Application of heavier doses of fertilizers than that given in treatment 3 does not, however, produce significant increase in the yield.

The study of response to treatments in the individual years indicates that there is a significant difference between treatment 2 and 1 except for two years 1936-37 and 1939-40 where the difference just fails to reach the 5 per cent level of significance. Treatment 3 has given higher yields over treatment 2 in all the years but the difference is significant only for two years, viz. 1934-35 and 1939-40 which happen to be the years when poorer yields were obtained. As observed above 1934-35 season was characterised by a wet weather over a month and a half and 1939-40 by a long drought and occurrence of cold waves during the growing period of the crop. Treatment 4 has given significantly greater yields than treatment 3 only during the seasons 1935-36 and 1937-38, while treatment 3 has out-yielded treatment 4 in three seasons although the difference is not significant.

On the average of seven years, treatment 4 has given an extra yield of only 32 lbs. per acre which difference is not significant.

Economics of Manuring.—The yields obtained by the application of different treatments on the average of seven years, with the cost of raising the crop and the profit or loss secured are shown in table V:—

TABLE V

Economics of manuring.

Treatments	Yield per acre in lbs.	Cost of cultivation including cost of fertilizers	Value of sale proceeds	Profit or loss per acre	Profit or loss over control
	Lbs.	Rs.	Rs.	Rs.	Rs.
1. 8 tons Farmyard manure per acre ...	841	91 13 6	149 4 0	57 6 6	...
Am SO_4 Super. K_2SO_4					
2. 8 ,, +180 lbs. + 370 lbs. +150 lbs.	1183	138 7 9	210 11 3	72 3 6	14 13 0
3. 8 ,, +230 lbs. + 480 lbs. +190 lbs.	1317	150 5 9	233 3 6	82 13 9	25 7 3
4. 8 ,, +280 lbs. + 585 lbs. +235 lbs.	1349	162 9 6	239 14 3	77 4 9	19 14 3

It will be observed from the above table that all the treatments were applied at profit compared to the control but treatment 3 gave the highest net profit of Rs. 25-7-3 over the control.

Summary and Conclusion.—Response to different doses of nitrogen, potash and phosphate in combination of a fixed ratio of roughly one of nitrogen to two each of potash and phosphate, in the form of Ammonium Sulphate, Super and Potassium sulphate in addition to the basal dressing of Farmyard manure at the rate of 8 tons per acre to Pandhurna Chillies is obtained. Nitrogen doses applied in the form of Ammonium Sulphate were roughly 36, 46 and 56 lbs. Nitrogen per acre. The fertilizers were applied in two doses, the first being applied a fortnight after transplanting and the second a month later.

The results show that on an average of seven years, treatment 3 viz. application of 230 lbs. Ammonium sulphate + 480 lbs. of Super + 190 lbs. of Potassium sulphate per acre in addition to the basal dressing of 8 tons of Farmyard manure per acre gave the optimum extra profit of Rs. 25-7-3 per acre over the control. (The manures have been added not in terms of quantities of the fertilizing constituents but in terms of the manures themselves).

The preliminary experiment suggests the laying out of a new experiment to study the effect of varying doses of Nitrogen, Potash and Phosphate in varying combinations. 3^3 type of experiment will provide a valuable information, the doses being 0, 25 and 50 lbs. of Nitrogen, Potash and Phosphate in all combinations.

Thanks are due to J. C. McDougall, Esquire, Director of Agriculture, Central Provinces, Nagpur for allowing to make use of the data and to Mr. S. P. Khare, Farm Superintendent, Powarkhera for supplying the necessary information in the preparation of this note.

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SELECTION ON THE BASIS OF COLOUR OF GRAIN AND ITS EFFECT ON THE FAT AND PROTEIN CONTENTS IN RICE

By Mr. R. H. Naqvi

In connection with the investigations on selection and maintenance of pure lines in paddy varieties, it was observed that there were certain cultures which, though pure for vegetative and spikelet characters, showed variation in kernel colour, dark to light. This variation in kernel colour was not however separable into distinct groups. To see whether the kernel colour depth was related to the Chemical composition of the kernel, the sample was divided into two groups according to the colour of the kernel, dark and light, and analysed separately for the fat and protein contents. The unselected whole sample was also analysed for comparison. The analysis did not show any clear difference among the three groups except a slight indication that the dark coloured sample may be richer in fat and protein. Subsequently, the dark group alone was sown and further selection made for dark colour in the kernel and this repeated for three seasons until the final produce had become uniformly dark, much darker than the original sample.

The paddy varieties dealt with in the experiment were K. E. 216 Assamia and Gopalbhog. Since the basis of selection was on the colour of the kernel, the spikelets were gently husked by hand and further generations raised from the husked rice. The germination was satisfactory 98 to 100 per cent. The dark coloured grains from each variety were separately sown and 30 plants from each selection were transplanted nine inches apart each way. The plants made normal growth and gave satisfactory produce. The produce from the selected plants was analysed every year and the data are presented in the table below:—

TABLE

Variety	Material	Percentage composition		
		Moisture	Fat (ether extract)	Protein albuminoids
K. E. 216	Unselected whole sample	11.65	2.31	6.63
	Dark colour selection 1st year	11.68	2.36	6.69
	,, ,, 2nd year	11.66	2.45	7.31
	,, ,, 3rd year	11.64	2.66	7.41
	Percentage increase	...	11. 5	12. 2
Assamia	Unselected whole sample	12.58	2.36	7.53
	Dark colour selection 1st year	12.49	2.41	7.62
	,, ,, 2nd year	12.50	2.45	7.97
	,, ,, 3rd year	12.55	2.67	8.32
	Percentage increase	...	11. 3	11. 1
Gopalbhog	Unselected whole sample	12.44	2.45	7.55
	Dark colour selection 1st year	12.45	2.51	7.96
	,, ,, 2nd year	12.41	2.57	8.01
	,, ,, 3rd year	12.40	2 85	8.66
	Percentage increase	...	11. 6	11. 5

The data definitely shows that the selection for depth of colour has led to a progressive and consistent increase in the fat and protein contents also. The produce at the end of third year in addition to its being uniformly dark in colour was also slightly bolder than the original sample with which the experiment was begun.

The investigation shows a definite relationship between the depth of colour in the kernel and its fat and protein contents, and bears out indirectly the evidence recorded previously that coloured rices have a thicker aleurone layers (Ramiah and Mudaliar, 1939) and that they are richer in protein and mineral constituents (Sadasivan and Sreenivasan, 1938). It also shows that the colour of the kernel a genetic character seems to respond to selection.

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Extracts

INDIA'S AGRICULTURAL RESOURCES

(PRINCIPAL CROPS AND WHAT HAS BEEN DONE TO IMPROVE THEM)

Indian agriculture, generally speaking, is peasant agriculture. The holdings are small, often fragmented, and largely worked by the peasant and his family.

The Indian farmer's working year is divided into two main agricultural seasons, the "kharif" and the "rabi", over a considerable part particularly of North and Central India. In some parts there is "double-cropping," which means that a crop is taken from the same land in both seasons; while in certain favoured areas in the south as many as three crops of rice a year can sometimes be obtained from the same land.

Here is a survey of India's principal crops and the work that has been and is being done to improve them :—

India's agricultural resources are determined by her geography, climate and soil. Over the greater part of India most of the rainfall occurs between the months of June and October, i.e. in the hot months of the year, the winter being comparatively dry.

The intensity of the rainfall in any given place is determined mainly by the position of the big mountain ranges. There is a block of country in North-West India which gets little or no rain, and there are precarious

areas in various parts of the peninsula proper, where rainfall may be good in some years and bad in others.

Conforming to the rainfall, there are two main cropping seasons, the *kharif* or rainy season, when crops are sown some time in June or July and harvested from October until December, and the *rabi* or cold weather season when crops are sown in September or October and harvested from February to May. There are certain crops of longer duration which are sown some time in the rains and harvested well on in the cold weather, such as certain kinds of cotton and groundnut.

"Return" Monsoon.—This simple scheme, however, does not, by any means, cover the whole of India. In parts of the South of India, there is also rain from the "return" monsoon in the period, November to February, and two or even three crops of rice may be taken in such circumstances. In such an area the division of the year into *kharif* and *rabi* does not hold. In parts of North India there is also rain in the form of occasional storms between November and February.

Indian crops may roughly be divided into crops producing food for the peasant and his family (also his cattle), and crops for sale or more shortly, food crops and cash crops. Here again, the division is not absolute as some crops may be grown for both purposes, but the general classification holds.

Among purely commercial crops cotton holds first place with an area of 21 to 25 million acres. India ranks as the second cotton-growing country in the world, the United States of America holding the first place. The following table gives the all-India area in acres, and the all-India production in bales of 400 lbs. each for the past ten years :—

Year		*Acreage (000 acres)*		*Bales (000 bales)*
1930-31	...	23,439	...	5,192
1931-32	...	23,494	...	4,003
1932-33	...	22,151	...	4,618
1933-34	...	23,692	...	5,057
1934-35	...	23,515	...	4,797
1935-36	...	25,444	...	5,867
1936-37	...	24,759	...	6,234
1937-38	...	25,746	...	5,722
1938-39	...	23,482	...	5,076
1939-40	...	21,356	...	4,942

The cotton produced is of many different types and its cultivation is scattered over many parts of India and not located in one belt as in

America. Bombay Province has about 30 per cent of the total area in India, but even within that province conditions are so diverse (largely due to its being a long narrow province stretching over several degrees of latitude) that it contains no less than four distinct cotton growing tracts, each with its own kind of cotton.

Cotton is a very old crop in India. Some time ago, archæologists, digging at Mohenjo-daro in Sind, about 200 miles from Karachi, unearthed a small piece of fabric which proved to be cotton. The civilisation to which this fabric belonged dates about 3000 B. C. Travellers from the Greeks to Marco Polo have described India's cotton cultivation, and there are many types of cotton indigenous to India. In addition about 1840, there was an import of American cotton seed (with American planters to grow it) from which seed some of the American varieties now in this country have been derived.

The following table shows the distribution of the Indian cotton crop for the year 1939-1940, classified according to length of staple and shown under some of the names by which these types are known to the trade in India :—

Indian cotton crop of the 1939-40 season classified according to staple length (from statistical Leaflet No. 1 1939-40, Indian Central Cotton Committee).

	Bales of 400 lbs each (Government official forecast)
Long staple—over 1 inch (Punjab-American 289F, including 289F/K—25 and K—23) ...	66,000
Medium staple A—1 inch (including Punjab-American 289F/43, Sind Sudhar, part of 1027 A.L.F. and part of Cambodia, Co. 2) ...	242,000
Medium staple B—7/8th to 31/32nds inch (including part 1027 A.L.F., part Cambodia, Jaywant, Punjab-American L.S.S. and 4F, etc.) ...	1,576,000
Short staple A—11/16ths to 27/32nds inch (including Salems, Dharwar-Upland, C. P. No. 1, Oomras, Hyderabad, Kumpta and Upland, Banilla, etc.) ...	843,000
Short staple B—9/16ths to 21/32nds (including C. P. Nos. 2 and 3 Oomras, Khandesh Oomras, Barsi and Nagar Oomras, Dholleras, etc.) ...	1,240,000
Short staple C—17/32nds and below (including Bengal from the United Provinces Rajputana, Sind and the Punjab, also Comillas.) ...	1,017,000
Total ...	4,984,000

Punjab-American Types.—It will be seen that the long staple and medium staple types are to be found in the Punjab and Sind. These types are of American origin and have been greatly improved by the efforts of the cotton breeders of the agricultural departments of these two provinces assisted by generous subventions from the Indian Central Cotton Committee. In these areas cotton is an irrigated crop, the water for this irrigation being derived from the highly developed systems of the Punjab or from the more recent Sukkur Barrage in Sind. The cotton of these types being suitable for higher counts has a substantial demand in Indian mills and a ready export market. An attempt to produce something still better is on the way, in the shape of a research financed by the Indian Central Cotton Committee and located in Sind, for the breeding of still longer staple cotton varieties suitable for that area. Suitable cottons from all over the world are being collected for use either in selection or hybridisation in this work.

The increase in the production of the Punjab-American cotton in the last six years is shown in the following table:—

Year		*Production of Punjab-American (Government Forecast) (000 bales)*
1933-34	...	10
1934-35	...	Not available
1935-36	...	20
1936-37	...	47
1937-38	...	54
1938-39	...	72
1939-40	...	66

Indigenous Cotton.—At the other end of the scale is an area of indigenous types comprising the Central Provinces, Berar, Khandesh, Central India, parts of the United Provinces and of Rajputana in which the main cotton produced is of short staple. About 1,000,000 bales of this are consumed annually in India. The biggest outside customer for this cotton has been Japan. In this area also, and particularly in the Central Provinces and Berar and in Khandesh, the plant breeders have been successful in producing types (such as Verum 434 in the Central Provinces and Jarila in Khandesh) which are in the ⅞ths class and which if spread will go a long way to reduce the dependence of this tract on so short a staple.

The shortness of staple of this area is to some extent connected with the fact that the cotton is grown on the rainfall, and that the season is of short duration. There are, however, other parts of India where cotton grown only on the rainfall attains quite a respectable length and some of the finest and best of the indigenous cotton varieties (improved, of course by the plant breeders) are to be found there. Such is the 1027 ALF cotton of the Surat District, of Bombay Province and in Baroda State and the Jaywant cotton of the south of that Province. In such areas also are to be found some of the American cottons such as the Dharwar American (also in the south of the Bombay Province) and the Cambodia in Madras.

Cess for research.—Cotton is fortunate in having had for nearly 20 years the attention of the Indian Central Cotton Committee, which meets twice a year, and which has a local and a finance committee that meet more often, and several technical sub-committees which deal with agricultural, technological and other questions before they come before the main Committee.

The Committee obtains its finance from a cess of two annas a bale on all cotton produced in India. It has the prepondering interest in the Institute of Plant Industry at Indore, and has as its own institute for technological work the Technological Laboratory at Matunga, a suburb of Bombay.

The all-India average yield of cotton per acre though, it has been considerably improved through the efforts of the plant breeders in the last ten years, is still relatively low (104 lbs. per acre in the five-year period, 1933-38).

The following table shows the relation between exports and utilisation by mills in India of the Indian cotton for the last ten years :—

Year	*Consumption by mills in India, (year ending June 30)*	*Exports from British India, (year ending August 31)*
1929-30	2,573,714	3,868,000
1930-31	2,633,176	3,729,000
1931-32	2,911,264	1,592,000
1932-33	2,837,158	2,868,000
1933-34	2,703,994	3,406,000
1934-35	3,123,418	3,115,000
1935-36	*3,188,418	3,709,000
1936-37	*3,146,752	*4,207,000
1937-38	3,652,648	2,100,000
1938-39	3,810,734	3,274,000

Figures prior to 1937-38 include Burma except those marked *

The Jute Crop.—Jute is found only in one part of India. Bengal produces about 90 per cent of the crop and the rest is to be found in the adjacent provinces of Bihar, Orissa and Assam. The crop is an old one in Bengal, but a comparative newcomer in Assam, where, however, it tends to increase.

The following table shows the annual area under jute in acres and the annual production in bales (of 400 lbs.) for the last ten years with the amount exported annually :—

Year		**Total acreage (000 acres)*		** Total production of bales (000 bales)*		*** Amount exported Raw Jute (000 bales)*
1930	...	3,492	...	11,205	...	3,472
1931	...	1,862	...	5,542	...	3,287
1932	...	2,143	...	7,072	...	3,153
1933	...	2,517	...	7,987	...	4,190
1934	...	2,670	...	8,500	...	4,213
1935	...	2,181	...	7.215	...	4,318
1936	...	2,886	...	9,611	...	4,598
1937	...	2,889	...	8,656	...	4,183
1938	...	3,165	...	6,819	...	3,870
1939	...	3,119	...	9,635	...	3,209

* India only. ** Figures prior to 1937 include Burma.

(It may also be mentioned that in 1926 the jute area was just under 4,000,000 acres and the production was estimated at 12,000,000 bales).

Jute is peculiar in its climatic requirements, its cultivation and its economics. It is sown between February and May and takes from three to four months to reach maturity, when it stands a solid mass of vegetation, six to ten feet high. It needs damp soil and warm wet weather and when well established, does not mind a certain amount of waterlogging. At flowering time the stalks are cut, tied into bundles after removal of the leaves, and left to soak in water, the so-called "retting" process. After two or three weeks the fibre is removed from the decaying matter of the stalk, washed and dried. All this is done by hand, in conditions of damp and heat, the workers often standing in water for hours.

Jute is a crop localized in Bengal and certain districts of Bihar, Orissa and Assam, with the centre of manufacture in Calcutta. The area under jute fluctuates considerably and in the last two years has been of the order of 3,000,000 acres with a production of from six to nine million bales of 400 lbs. each.

The ground is prepared in the yearly early rain and the seed is sown not later than May. Just before the seed sets, the crop is cut, and after a

few days stacking is retted in water for about three weeks when the adhering and rotting matter is removed from the fibre by beating and washing. After drying the fibre is sold. Its colour, lustre, strength, and fineness which depend on variety and also on time of harvesting and the character of the retting, govern its commercial value.

Research work on all aspects of these problems is being carried out under the auspices of the Indian Central Jute Committee, whose agricultural research station is at Dacca and its Technological Laboratory in Calcutta.

Most of the important industrial countries used to figure as purchasers of raw jute, Great Britain and Germany being the chief buyers.

Oil seeds.—Oil seeds form an important group of "cash" crops. By far the most important of them is groundnut, occupying about 8,000,000 acres with a yield of about 3,000,000 tons. Groundnut was not always grown in India and how and when it came to this country is not exactly known. Its extension has been rapid and continuous especially since 1924.

Groundnut has various Indian names, most of them (like the European names) indicating its habit of burying its fruit, but one of the names suggests a Chinese origin. The province which produces most groundnut is Madras the next being Bombay.

Figures for the acreage and production of the whole of India for the eleven years are given in the following table:—

Year		*Acreage (000 acres)*		*Production (000 tons)*
1929-30	...	5,177	...	2,180
1930-31	...	6,014	...	2,592
1931-32	...	5,081	...	2,151
1932-33	...	6,887	...	2,846
1933-34	...	7,586	...	3,186
1934-35	...	5,141	...	1,740
1935-36	...	5,197	...	2,114
1936-37	...	6,663	...	2,714
1937-38	...	8,898	...	3,501
1938-39	...	8,506	...	3,219
1939-40	...	8,112	...	3,002

There are various types of groundnuts of which the following are the chief: Mauritius, Big Japanese, Small Japanese and Spanish Peanut. The present war has hit the groundnut grower on account of loss of markets and prices have slumped in consequence, both for the seed and the cake.

Mixed Crops.—Linseed occupies annually about 3,500,000 acres chiefly in the Central Provinces, the United Provinces and Bihar, though there is a good deal of cultivation scattered over other parts of India. In the Crop Planning Conference held in India in 1934 this was one of the few crops the expansion of which was definitely recommended. India is a country in which it is often the practice to grow mixed crops, i.e., more than one crop in the same field, not usually mixed higgledy-piggledy but a certain number of lines of one and then a certain number of lines of another. This is to some extent an insurance against the vagaries of the rainfall, since one of the crops at least is likely to come through. Linseed is often grown in this fashion, making accurate estimate of total area far from easy. A valuable source-book on the whole linseed question is the report on the Marketing of Linseed in India issued by the Agricultural Marketing Adviser in 1938 (obtainable from the Manager of Publications, Delhi, price Rs. 1-4).

The following table shows the acreage and production and amount exported for the last eleven years:—

Year		**Acreage* (*000 acres*)		**Yield* (*000 tons*)		***Quantity exported* (*000 tons*)
1929-30	...	2,802	...	380	...	248
1930-31	...	3,009	...	377	...	257
1931-32	...	3,309	...	416	...	120
1932-33	...	3,299	...	406	...	72
1933-34	...	3,261	...	376	...	383
1934-35	...	3,410	...	420	...	240
1935-36	...	3,457	...	388	...	165
1936-37	...	3,677	...	420	...	294
1937-38	...	3,890	...	461	...	226
1938-39	...	3,869	...	442	...	318
1939-40	...	3,713	...	467	...	...

*India only   **Figures prior to 1937-38 include Burma.

Rape and Mustard.—There is an important group of oilseeds belonging to the mustard group and mainly grown in Northern India. We need not go into the botanical differences between these. Taking them as a whole, rape and mustard cover annually about six million acres and yield about a million tons of seed. The oil is put to many uses and is a first-class culinary oil. The crushing of the seed is done both in small village installations and also in modern factories. The oilcake is an important cattle food. There used to be a large export of these seeds, amounting sometimes to as much

as half of the total production, but with the exception of the type known as *toria*, the whole production is now consumed in India.

Castor Seed.—Castor seed comes from a plant that grows easily in many parts of India. It is tough in constitution and seems to stand up to all kinds of climate. It is found in Sind, an arid area, but it was also the crop which did best in lands recovering from the big floods in the Gujarat Division of the Bombay Province some years ago. The Nizam's Dominions has the biggest share of the castor area in India and here is located a research scheme financed by the Imperial Council of Agricultural Research, for the improvement of the yield and oil-content of the crop. The all-India figures for acreage and yield for the last eleven are as follows:—

Year		*Acreage (000 acres)*		*Yield (000 tons)*
1929-30	...	1,285	...	116
1930-31	...	1,457	...	120
1931-32	...	1,583	...	146
1932-33	...	1,617	...	151
1933-34	...	1,534	...	143
1934-35	...	1,448	...	105
1935-36	...	1,438	...	121
1936-37	...	1,409	...	128
1937-38	...	1,148	...	104
1938-39	...	1,199	...	111
1939-40	...	1,009	...	94

There used to be a large export of castor seed but this has diminished considerably in recent years as the following figures show:—

Year		**Exports (seed) Tons.*
1933-34	...	81,559
1934-35	...	68,649
1935-36	...	59,968
1936-37	...	43,089
1937-38	...	42,079
1938-39	...	7,621

*Figures prior to 1937-38 include Burma.

India is therefore using more and more of the crop produced within her borders. The cake is a valuable manure, and has at the present moment not suffered the price slump which has hit groundnut cake.

Cotton Seed.—The position regarding cotton seed is that there is a large production but little export. The figures of export for the last nine years are as follows:—

Year		*Cotton seed exported Quantity (tons)
1930-31	...	41,350
1931-32	...	11,655
1932-33	...	23,389
1933-34	...	5,575
1934-35	...	636
1935-36	...	730
1936-37	...	9,003
1937-38	...	5,008
1938-39	...	465

*Figures prior to 1937-38 include Burma.

Cotton seed is used very largely in India as a cattle feed. There are also one or two mills which crush the seed and produce cottonseed oil.

Wheat.—The second cereal in order of importance in Indian agriculture is wheat of which there is annually a total area of about 35,000,000 acres and a total output of from 9,500,000 to 10,000,000 tons. Of wheat there are two principal species grown in India, one of these being the normal "bread" wheat of Europe and the other the so-called "Macaroni" wheat.

Wheat is mainly produced as an irrigated crop in the Punjab, Sind and the United Provinces. There is also an important but much smaller area in the black soil area in the Central Provinces and part of the Bombay Province where *durum* wheats are grown, as a rain-fed crop. The following table gives all-India acreages, yields and exports for the last eleven years :—

Year		*Acreage (000 acres)		*Yield (000 tons)		**Export (000 tons) Wheat		Wheat-flour
1929-30	...	31,654	...	10,469	...	13	...	51
1930-31	...	32,189	...	9,306	...	197	...	47
1931-32	...	33,803	...	9,024	...	20	...	43
1932-33	...	33,976	...	9,455	...	2	...	21
1933-34	...	36,077	...	9,370	...	2	...	13
1934-35	...	34,490	...	9,729	...	11	...	12
1935-36	...	33,639	...	9,434	...	10	...	18
1936-37	...	33,215	...	9,752	...	232	...	24
1937-38	...	35,640	...	10,764	...	460	...	62
1938-39	...	35,291	...	9,934	...	279	...	61
1939-40	...	34,003	...	10,784	...	...	...	...

*India only. **Figures prior to 1937-38 include Burma.

The wheats grown in the Punjab, Sind and the United Provinces are of the bread type. The plant breeders of the agricultural departments have devoted much time to the improvements of these wheats with conspicuous success. In the Punjab two recent winners are C. 591 and C. 518. Unlike the state of affairs in some of the other wheat-producing countries of the world, Indian wheat-production is not mechanised. This crop was the subject of the first of the reports of the Agricultural Marketing Adviser (Report on the Marketing of Wheat in India, 1937, obtainable from the Manager of Publications, Delhi, price Rs. 1-4). This is a useful source-book not only as regards marketing but also on many other aspects of the crop.

Wheat export from India has been a very fluctuating quantity, and is noticeable only when world prices for this commodity are high. Some idea of this fluctuation may be obtained from the following figures for certain years. In 1900-01 it was practically non-existent. In 1904-05 it was over 2,100,000 tons. In 1908-09 it was about 100,000 tons, during part of the last war it rose to about 1,700,000 tons; was negligible for a time after 1917 and rose to 100,000 tons in 1924-25. In 1929-30 it was only 13,000 tons; in 1930-31, 197,000 tons; in 1932-33 only 2,000 tons, in 1937-38, 460,000 tons.

Rice.—Rice occupies the biggest total area about 72 million acres in a good year, with an annual yield of about 25 million tons. Over a great part of Indian rice is the principal food crop, but even with the comparatively large production of rice in India, there is annually a big import of rice from Burma, an import which may go up to 2,000,000 tons a year, to supplement the internal supply.

In no crop is India's "infinite variety" so clearly shown as in her rices. Equally variable are the ways in which rice is grown. At the one end of the scale we have the deep-water rices of Assam which elongate as the flood rises until the stalk may be 8 feet long. At the other end we have, in the Baroda State and parts of the Gujarat Division of Bombay Province, rice varieties which are grown in the same field as and in alternate lines with cotton, i. e., as a crop grown on the rainfall without any flooding whatever.

Over the greater part of India, rice is grown in flooded fields. In these the rice is either broadcast or transplanted, the transplanting of rice being done from carefully prepared nursery beds, and it is the transplanted rice that gives the highest yields.

Rice may be irrigated, as in Sind or Madras, or grown on the rainfall only as Bombay and Bengal. Generally speaking, a rainfall of fifty

inches and above is required for the growing of rice without irrigation. The following table shows the area and output of rice in India for the last eleven years:—

Year		*Acreage (000 acres)*		*Yield (000 tons)*
1929-30	...	67,619	...	26,146
1930-31	...	69,663	...	27,055
1931-32	...	71,745	...	28,799
1932-33	...	69,960	...	26,201
1933-34	...	70,340	...	25,733
1934-35	...	69,731	...	25,706
1935-36	...	70,998	...	23,213
1936-37	...	72,295	...	27,828
1937-38	...	72,568	...	26,702
1938-39	...	73,375	...	23,915
1939-40	...	72,340	...	25,257

Compared with the average yields of some other rice-growing countries the Indian average may appear small. The all-India average yield per acre is about 800 lbs. Broadcast rice may give only 600 lbs. per acre, but transplanted rice in really good conditions may give 3,000 lbs. per acre and where there has been good manuring and personal attention as on certain well run estates in South India even 4,000 lbs. per acre have been got. These figures all mean paddy (unhusked rice).

Yields have also been improved by the production in all rice provinces of better varieties through the activities of plant breeders.

Grower's difficulties.—The rice grower in India has one or two curious difficulties to contend with. One of these is the presence in certain areas of wild rice. The earhead of wild rice has the habit of "shattering" i. e. breaking up while still on the plant, this being its way of sowing itself. Wild rice easily crosses in nature with cultivated rice and unfortunately passes on to the hybrid this bad habit. The breeding of rices which have some colour which enables them in the seedling stage to be differentiated from the wild rice, permitting the elimination of the latter, is one of the likely lines of advance.

Land crabs are another pest of rice. Not only do they eat the plants but they also bore holes in the embankments of the rice fields and so let the water out. Various remedies such as baits, poisoning and gassing have been tried, but the problem is not yet entirely solved, particularly as regards cost. The main rice-eating provinces are Bengal, Bihar, Orissa, the Central Provinces and Madras.

In the United Provinces wheat is of equal importance. In Bombay the millets have also a food importance.

Sugar-cane.—The area and output of sugar-cane increased after the grant of fiscal protection to sugar which has been in operation since the year 1932.

Year		*Acreage (000 acres)*		*Yield (000 tons)*
1929-30	...	2,513	...	2,752
1930-31	...	2,801	...	3,228
1931-32	...	2,971	...	3,975
1932-33	...	3,317	...	4,676
1933-34	...	3,311	...	4,896
1934-35	...	3,481	...	5,140
1935-36	...	4,024	...	5,931
1936-37	...	4,440	...	6,476
1937-38	...	3,869	...	5,403
1938-39	...	3,113	...	4,108
1939-40	...	3,766	...	4,733
1940-41	...	4,215	...	...

Indian sugarcane varieties have been greatly improved particularly by the efforts of the plant-breeders at Coimbatore and the canes with the initials Co., followed by a number, are now known and many of them planted, not only in India but in many other sugarcane growing countries. The original intention of the Coimbatore station was to breed canes for Northern India, and in this it has been successful. It has also produced canes which suit tropical India and canes for this part of the world have also been produced by the Mysore plant-breeders. As much as 75 per cent. of the sugarcane area in India is now covered by improved canes, a condition of things not even distantly approached in any other crop in India. India has some wild sugar-cane species and the "blood" of these has been incorporated by hybridisation into some of the improved canes, thereby giving them toughness of constitution and resistance to adverse conditions.

Previous to the increased developments of the white sugar industry, sugar-cane was crushed in small bullock-driven mills for the production of a substance known in different parts of the country as *gur*, *gul* or *jaggery*. This is produced by boiling the expressed juice in a big shallow iron pan over a crude furnace usually with the addition of some clearing agents which enable impurities to be skimmed off, and then pouring the brown thick fluid at just the right stage into moulds where it solidifies.

The production of *gul* still accounts for the greater part of the sugar-cane grown in India, and *gur* is an important part of Indian food. It varies greatly in colour, consistency, taste and keeping qualities. Recently in some places activated carbon has been used to give a very high quality *gur*.

There is also the use of sugar-cane for the indigenous sugar industry, making the so-called *khandsari* sugar. This again is a small scale industry but normally requires some source of power for the driving of the centrifugals. The amount of *khandsari* sugar produced annually in India is of the order of 1,25,000 tons.

The improvement of sugar-cane cultivation, the study of its pests and diseases, and the investigation of its physiology are being carried out at a chain of research stations throughout India, also at the Imperial Agricultural Research Institute at New Delhi and its sub-stations, and with the collaboration of many factory estates, while the technological side is looked after by the Indian Institute of Sugar Technology at Cawnpore.

The Millets.—The most important of these is the great millet (*Andropogon sorghum*) known over a great part of Northern and Central India as jowar. In Southern India it is called cholam. This is the sorghum of America. India is peculiarly rich in jowar varieties, which centuries of natural and human selection have adapted to all sorts of conditions and purposes. Many of the jowars produce food for both man and beast, the grain being used for men and the dried stalks (known over a great part of India as *Kerbi*) being cattle food. There are also varieties which produce little grain but sweet succulent stalks and which are known as green fodder.

Some varieties are adapted for the *kharif* and some for the *rabi* season. In India as in Africa this millet suffers in some places from the little flowering parasitic plant botanically known as Striga (in Africa called witchweed), and work is in progress at Poona and elsewhere to find varieties resistant to this pest. Breeding of better varieties is being done in various centres of agricultural research, chiefly in the Punjab, Madras and Bombay.

The next most important millet is *Pennisetum typhoideum* (known in Northern and Central India as bajri or bajra) and in South India as cumbu. In other countries this is often called pearl millet. The head is like that of a bulrush and the grains are small and with a pearly lustre. Bajri is a crop which tolerates poorer soils and smaller rainfall than jowar. Like jowar its grains are used for human food and its stalks as fodder.

The grains of both millets are regarded as having higher food values than rice. The areas and yields under each of these for the last ten years are as follows:

JOWAR

Year		Acreage (000 acres)		Yield (000 tons)
1929-30	...	35,236	...	6,878
1930-31	...	35,173	...	6,928
1931-32	...	33,887	...	6,149
1932-33	...	33,449	...	6,412
1933-34	...	32,167	...	6,138
1934-35	...	33,478	...	6,255
1935-36	...	32,825	...	6,159
1936-37	...	37,220	...	7,098
1937-38	...	33,489	...	6,506
1938-39	...	33,812	...	6,435

BAJRA

Year		Acreage (000 acres)		Yield (000 tons)
1929-30	...	17,271	...	2,284
1930-31	...	17,524	...	2,583
1931-32	...	18,310	...	2,673
1932-33	...	18,699	...	2,598
1933-34	...	16,552	...	2,128
1934-35	...	17,031	...	2,549
1935-36	...	16,911	...	2,681
1936-37	...	16,103	...	2,433
1937-38	...	17,242	...	2,625
1938-39	...	17,216	...	2,540

There are one or two other crops of the millet group, some of them being what look like only partially domesticated grasses, but one is worth mentioning, namely *Eleusine Coracana* (known as ragi). This has a very small grain and occupies poor lands in areas that otherwise grow rice. Some plant-breeding work has been done on this species in Bombay Madras and Mysore and it has its place in the agriculture of certain areas.

Pulse Crops.—India has a great range of pulse crops. These pulse crops are important both from the point of view of husbandry and of nutrition. They are an invaluable phase in many rotations helping to keep up the fertility of the soil, which purpose they also perform when grown (as they often are) as mixed crops, particularly with millet, the millet ripening and being harvested first. In the realm of nutrition they are sources of

protein, particularly necessary in a country where the bulk of the population is vegetarian. They are also important from the point of view of animal nutrition, to which they contribute in a variety of ways, e. g. by their seeds, by their hulls, and by the green parts of the plant.

Gram (*Cicer arietinum*) and *tur* all called (*arhar* or *rahar*) are probably the most important and most widely grown. The annual areas and yields of gram for the years 1929-30 to 1937-38 are as follows:—

Year		Acreage (000 acres)		Yield (000 tons)
1929-30	...	13,175	...	3,051
1930-31	...	15,223	...	3,400
1931-32	...	17,735	...	3,766
1932-33	...	15,803	...	3,439
1933-34	...	18,443	...	3,737
1934-35	...	15,638	...	3,629
1935-36	...	16,687	...	3,840
1936-37	...	17,626	...	4,115
1937-38	...	15,742	...	3,525

Diversity of fruits.—In fruit production there are great possibilities, but generally speaking and with certain marked exceptions, both the varieties and the methods of cultivating them require considerable improvement. To these ends a good deal of effort is being devoted by agricultural departments and by the Imperial Council of Agricultural Research, the body which is charged with the task of stimulating, co-ordinating and helping to finance agricultural and animal husbandry research throughout India.

The total area under fruit is probably between 3,000,000 to 41,000,000 acres. There is a great diversity of fruits grown in India among which may be mentioned the mango, oranges of various kinds, the pomelo, more recently the grape-fruit, papayas, figs, bananas, guavas, and some less known fruits such as the chiku (= the sapodilla-plum), the litchi, and the custard apple.

In the north, where there is a cold winter, we find apples, pears, peaches, quinces, plums, cherries and grapes. Kashmir is noted for its apples, also certain portions of the lower hills in the Punjab and the United Provinces. Some gifts of nature (aided perhaps by the Portuguese or other early gardeners) such as the Alphonso and some other varieties of mango are extraordinarily good but, generally speaking, there is a lot to be done in the improvement of the quality of Indian fruits. Investigations with this end in view are in progress at a chain of fruit research stations throughout India.

An attempt was made some years ago to work up a trade with the United Kingdom in mangoes. As a result of cold storage investigations in India, the suitable temperatures for carrying this fruit are now known, also the stage at which it should be picked and the varieties which travel best, but export has been rather held up on account of a variety of snags, and also because of the difficulty of putting the fruit on the British market at a price that would make it popular. Fruits taken altogether cover about 2½ million acres in India, much of the cultivation being of a rather scattered nature.

The marketing of fruit has also been the subject of investigation by the Agricultural Marketing Adviser. The canning of fruit and bottling of fruit juices has for several years been under study, particularly at the Punjab Agricultural College, Lyallpur. Fruit canning has not yet developed very far, though there are one or two companies whose products are on the market, but the bottling of fruit juices has gone ahead in certain areas particularly in the Punjab. Experiments are also being made with the drying of fruit in the North-West Frontier Province, in Baluchistan and in the Punjab.

Fibres.—Mention has already been made of cotton and jute. In addition, India produces no small amount of the so called sunn hemp *(Crotalaria juncea)*. This plant is also extensively used as a green manure, particularly for sugarcane. The area grown for fibre is about 600,000 acres annually and annual exports amount to about 800,000 cwt. Another fibre plant widely grown is *Hibiscus cannabinus* (known by various names such as ambadi, mesta pat, and Bimlipatam jute). This is of more local importance. It should be mentioned that both fibres are used for making ropes and twine for village use in India.

The rozelle or rozella (*Hibiscus Sabdariffa*) which is now being grown in the Netherlands Indies as a fibre plant, grows easily in India, but its cultivation is small and scattered and, where grown, it is generally cultivated for its succulent calyx from which preserves can be made. Throughout India the traveller will often see plants of *Agave* (often wrongly called aloes) grown particularly as a fence on certain railway lines. The sisal hemp, *Agavel sisalana*, which belongs to this group, has been tried more than once in India, and, given suitable conditions, can do quite well, but no large sisal plantations exist.

The planting.—Three quarters of the tea area in India is in Assam and the neighbouring parts of Bengal, and the rest of the tea is in South India, mainly in the Nilgiri Hills. In Northern India, the tea planting industry has utilized science to the full starting with an embryonic organisation in

the early years of this century and having now a highly organized scientific department maintained by the Indian Tea Association with its research station at Troklai in Assam.

In Southern India the United Planters Association have also utilized scientific workers for the solving of the problems of both tea and coffee, the Mysore State jointly with the Association financing the Coffee Research Station at Belehonnur. The area under Coffee is rather over 180,000 acres and the Indian Coffee Cess Committee is concerned with propaganda to increase the consumption of Indian coffee both in India and abroad.

Rubber is grown on 125,300 acres in South India mainly in Travancore State with some also in Madras, Cochin, Coorg and Mysore.

India can grow many things of which at present there are very limited areas (such as cinchona), or merely a few plants here and there (such as cloves and variety of drugs.) Pyrethrum has been tried in a great many places in India and has been a success in Kashmir and in certain of the lower foothills of the Punjab.

Tobacco.—Tobacco is a crop that does well in many parts of India. History records that the plant was introduced by the Protuguese at the beginning of the 17th century. Up till recently the tobacco grown was used for smoking in the water-pipe (the hookah), in the form of the bidi (chopped tobacco rolled in a leaf; that is, a primitive cigarette) or in the form of cheroots and cigars.

Of recent years it has been shown that tobacco of the Virginia type suitable for the paper-covered modern cigarette can be grown in India, at least in certain tracts, and that if good varieties are used and the leaf properly cured in flue-curing barns, a satisfactory product can be guaranteed.

Guntur, in Madras, is an important centre of Virginia leaf production, and the Mysore State has given the cultivation of this kind of leaf its powerful backing and the benefits of organization. Mention should also be made of the Indian Tobacco Leaf Development Company which has done much to popularise these types.

In 1939 the production in India of Virginia tobacco was estimated at 54,000,000 lbs. Before 1937 exports to the United Kingdom were about 16,000,000 lbs. a year. In 1938 there was a sudden increase and thereafter a falling off. India could produce a much greater quantity of good cigarette tobacco and the problems of its agriculture, curing and marketing are receiving close attention.

Flax was the subject of experiment from 1906 till about the end of the last war and is again being tried.

Soya bean has been experimentally grown in every province and many states in India, but has never taken a hold in the agriculture of the country on account of the lack of a market, and the fact that except in a very limited area the bean is not appreciated as food.

Coconut plantations.—There is not a tree so characteristic of the tropical coast as the coconut, and a fringe of coconut plantations is found along a great part of the Indian seashore. But it is a mistake to suppose that the coconut cannot grow away from the sea. There are good plantations at Mysore and there are scattered good trees at Poona. Coastal areas, however, remain the natural sites for coconut cultivation. In India the main coconut area is in the South Madras, Travancore and Mysore having the bulk of it. In certain coastal districts of Bombay, Orissa and Bengal the coconut is aiso important. The total area in India is about 1,388,000 acres. Nuts for seed are on the West Coast harvested from February to May, planted in nurseries and then transplanted to the field, after about six months, the number of trees per acre usually varying between 60 to 100. Fruiting may start in a small way about the sixth year and be going strong by the tenth with an expectation of a further forty years of good yielding life.

The main products are the nuts, the copra and the oil. Copra (the dried white meat of the nut) is manufactured either by the cultivators or by professional copra makers. Copra may be of edible quality or crushing quality with various grades within each group. The town of Alleppey is a big copra market. Bombay and Karachi are the main centres of copra crushing for oil production, but there are also power driven and bullock driven plants in South India. Coconut oil-cake is an important bye-product of the crushing industry. (*Indian Information, December 15, 1940.*)

College and Hostel Notes

The Annual Social Gathering of the College is the chief event of the period under report. The gathering was held from 6th to 9th December 1940. The programme included, chiefly, an address by the Advocate-General, Mr. W. R. Puranik, B.A., LL.B. We are extremely grateful to him for sparing his precious time for us inspite of his pressing duties. His address was highly illuminating, in which he pointed out the important place of agriculture in Indian life since very ancient times and encouraged us to strive hard in the interest of the tiller of the soil.

Sports formed almost the integral part of our social gathering celebrations Our play-grounds were buzzing with great activity throughout the week. Inter-class matches in Hockey, Football and Volley-ball evoked a very healthy rivalry between different classes. The final match in the tennis tournament (singles) was played between the veteran,

B. B. Banerjee of the III year and an enterprising youngster, M. S. Sonwalkar of the II year. The latter has recently struck very fine form, though after a good fight he went down in straight sets against a more experienced opponent. Another tennis match (doubles) which was played between the staff and the students created great interest, owing to a very fine performance by Mr. J. F. Dastur and Rao Bahadur D. V. Bal, who representing the staff, fought valiantly and bagged the trophy. Co-operation between the staff and the students in making the gathering what it really is, was further exemplified by the other sports in which they vied with each other for laurels viz. the tug of war and a cricket match. The cricket match which proved to be a very interesting item in the Social Gathering has given a very fine promise. With it cricket may almost regain its place in our College, provided the necessary funds are available. In an intersectional relay race between the members of the College Staff it was a pleasure to see the age and the youth striving hand in hand in a grand race, which resulted in a win for the Plant-Pathology section. An athletic tournament which extended over two mornings was keenly competed by the students.

Prizes were given away by Mr. W. R. Puranik for proficiency in sports, studies, elocution and arts.

Mainly due to the efforts of Mr. R. H. Joshi an arts exhibition, was arranged and there was a very encouraging response. A variety of exhibits including paintings, sketches, nail drawings, cottage industry products, etc. were displayed in a nicely decorated hall and were highly appreciated as they impressed the guests to find us excelling in the fineries and embellishments of life even though we are embedded in what is supposed as a prosaic and hard preoccupation of agriculture.

This most pleasant function ended with a dinner in Indian style which was finely arranged in the College Hostel. This year's Social Gathering was indeed a great success; thanks to the kind guidance of the Social Gathering Committee comprising of our Principal, E. A. H. Churchill Esquire, Dr. V. G. Vaidya and our hostel wardens, Messrs. S. K. Misra and K. S. S. Iyer. A whole-hearted co-operation of the members of the College Staff was of great value to us. We will be failing in our duty if we do not express our great appreciation of the work of various office-bearers and the volunteers who have laboured unremittingly night and day to make the gathering a success.

RECIPIENTS OF THE COLLEGE COLOURS

SESSION 1940—41

Hockey :— 1. Mr. Ajit Singh, 2. Mr. M. S. Sonwalkar, 3. Mr. S. L. Shrivastava.
Football:—1. Mr. P. M. Ingley, 2. Mr. G. T. Saoji, 3. Mr. B. B. Banerjee.

LIST OF PRIZE WINNERS IN THE COLLEGE SPORTS

SESSION 1940—41

Best Sportsman	... 1. Mr. R. S. Raghuwanshi	III Year
1. Three Mile Race	... 1. Mr. R. S. Raghuwanshi	III Year
	2. Mr. K. K. Kaushal	I Year
2. One Mile Race	... 1. Mr. R. S. Raghuwanshi	III Year
	2. Mr. K. K. Kaushal	I Year

3. 880 Yards Race ...	1. Mr. R. S. Raghuwanshi	III Year
	2. Mr. R. N. Mahranwar	II Year
4. 220 " ...	1. Mr. R. N. Mahranwar	II Year
	2. Mr. Trilochan Singh	III Year
5. 100 " ...	1. Mr. R. N. Mahranwar	II Year
	2. Mr. B. P. Mishra	I Year
6. Long Jump ...	1. Mr. V. D. Barve	II Year
	2. Mr. G. T. Saoji	II Year
7. High Jump ...	1. Mr. Trilochan Singh	III Year
	2. G. D. Dubey	I Year
8. Sack Race ...	1. Mr. V. D. Barve	III Year
	2. Mr. A. D. Kane	IV Year
9. Bullock Race ...	1. Mr. S. R. Chopde	III Year
	2. Mr. B. C. Jain	I Year
10. Slow Cycling ...	1. Mr. Trilochan Singh	III Year
	2. Mr. Ajit Singh	III Year
11. Cock Fight ...	1. Mr. V. L. Golhar	IV Year
12. Swimming:—100 Yds	1. Mr. V. R. Deshmukh	IV Year
	2. Mr. Trilochan Singh	III Year
	Mr. V. B. Rasal	I Year
220 Yds....	1. Mr. V. B. Rasal	I Year
	2. Mr. V. R. Deshmukh	IV Year
13. Relay Race (Students)	Mr. S. K. Palnetkar Mr. Ajit Singh Mr. Trilochan Singh Mr. P. M. Ingley.	III Year
(Staff)	Plant-Pathology Section Mr. J. F. Dastur Mr. R. L. Gupta	
Shot Put ...	1. Mr. Mokashi	IV Year
	2. Mr. Trilochan Singh	III Year

14. Tug of War (Students) *Vs.* (Staff) Winners—Students.

TENNIS

Singles	Mrs. Churchill's Cup Winner ...	Mr. B. B. Banerjee.
	Runner up ...	" M. S. Sonwalkar.
Doubles	Mr. S. K. Misra's Cups Winners ...	Mr. R. P. Jyotishi.
	...	" Ajit Singh.
"	(Staff *Vs.* Students) Winners ...	R. B. D. V. Bal.
	...	Mr. J. F. Dastur.

INDOOR GAMES

Table Tennis ...	1. Mr. V. L. Golhar, Mr. S. A. Stevenson
Bridge ...	1. Mr. S. A. Joshi and Mr. M. J. Khare
...	2. Mr. Ajit Singh and Mr. B. B. Banerjee
Chess ...	1. Mr. M. K Oke, Mr. S. L. Patni
Carrom Doubles ...	1. Mr. B. B. Banerjee and Mr. R. P. Jyotishi
...	2. Mr. S. N. Khutate and Mr. R. N. Khandelwal
Carrom Singles ...	1. Mr. R. P. Jyotishi, Mr. Trilochan Singh

INTER-CLASS TOURNAMENTS

Football ... III Year; Hockey ... II Year; Volley-ball ... IV Year.

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Editorial Notes

HIS EXCELLENCY'S VISIT TO THE COLLEGE

Wednesday, 8th January 1941, was a Red Letter Day in the annals of the College. His Excellency Sir Henry Twynham, Governor of the Central Provinces and Berar honoured us with a visit. During the morning hours, His Excellency saw the College, the Agricultural Research Institute, the Hostel and part of the Farm.

In the Hostel, the General Secretary Mr. P. M. Ingley and the Games Secretary Mr. S. K. Palnetkar, had the honour of being presented to His Excellency, who then passed on to the Farm, where he was able to see one of the classes at work.

In honour of the occasion, the College was granted a holiday and was closed for the rest of the day.

STIMULATION AND CO-ORDINATION OF AGRICULTURAL RESEARCH

Association for the advancement of Research in Agriculture and allied subjects:

Agricultural Research is a matter of prime importance to India, a country which has agriculture as its main stay. In recent years a fairly broad and bold plan of agricultural research has been embarked upon by the Imperial Council of Agricultural Research and the various Provincial Governments and States. Appreciable progress has also been made so far by these institutions in the form of evolving new varieties and finding out better methods of agriculture. This progress has of necessity been achieved by the specialization of the different branches of agriculture and

cognate sciences. Those responsible for the initiation and control of research have always endeavoured to collate together the results obtained by the various research workers independently of each other before recommending them for general use. However, the practical application of the results obtained by the different branches of the research workers involves a deep consideration of the problems arising out of it in a number of ways and from different angles of vision. This is best done by placing the results for an examination at the hands of a number of specialists, who would assist by offering their views and suggestions. Where the proposed improvement has a phenomenal intrinsic value like that of the Coimbatore canes which sprang into popularity almost magically little effort is needed to bring home to the agriculturist the benefit of the scientific research. But the path of all research is not so smooth, advancing as it does a steep, rocky and up-hill way. Constrained and concerted action can alone help in advancing every step further. With this end in view every research worker in the field may give a better account of himself and his researches may fare better in their usefulness if an opportunity is created to afford him to benefit by contact with other workers who may be able to view it from different stand points and offer their suggestions. An attempt to bridge the gulf between the highly specialized workers in the different branches of agriculture and the allied sciences is calculated to stimulate agricultural research and enhance its utility to the agriculturist.

A recent attempt in this direction made by the research workers in the College of Agriculture and the Agricultural Research Institute at Nagpur, by starting the "Association for the Advancement of Research in Agriculture and allied subjects" deserves great praise and enthusiastic support from all those interested in the advancement of knowledge and practise of agriculture. Credit is due to Dr. R. H. Richharia, M. Sc., Ph.D., Oilseed Specialist and Rao Bahadur D. V. Bal, M.Sc. (Agr.) (Hons.), A.I.C., F.C.S. (Lond.), Post-graduate-Pusa and Rothamsted

(Eng.) Agricultural Chemist to Government, C. P. and Berar, who have taken keen interest in starting this Society, which is one of its kind in this province. The example is wellworth emulating elsewhere, while the progress of the association may be watched with keen interest. A report of the proceedings is given later in this issue.

The Indian Society of Agricultural Economics

Another Society which is of recent origin but has relatively made considerable progress by getting regionally a wider support and approbation is the above named Society. It was organized mainly at the suggestion of Mr. Elmhirst, President of the International Conference of Agricultural Economists. The objects of the society are the promotion of investigation, study and improvement of the economic and social conditions of agriculture and rural life.

The Society entered its third year of life by holding its Second Annual Conference at Lahore in April 1941 under the distinguished Chairmanship of Sir T. Vijayaraghavacharya, K.B.E., Dewan, Udaipur State. Papers were read on selected topics of immediate importance and thread-bare discussions followed. The Conference, thus affords an opportunity for tackling together the various problems of agricultural economics which we are called upon to face from day to day. With the growing importance of Agricultural Economics in modern times, the Society is expected to do a great service by pointing out the directions in which agricultural progress may be made.

The Punjab Board of Economic Enquiry

Another institution the like of which we do not come across elsewhere in India is the Punjab Board of Economic Enquiry. The Punjab Board has made its name due to its various publications regarding the Punjab Village Surveys, Agricultural Costings and the investigations into the several aspects of the life and labour of the agriculturists. The enquiries are carried out by qualified persons under the supervision of University Professors and Government Officials. The Board—a non-official

body—is partly financed by the Government but is mostly run by honorary workers. It has achieved signal service by collecting data which has been of great value to the land owners, industrialists and businessmen. Its usefulness to the Government is immense owing to the help rendered by it in basing Government policies on the facts and figures thus made available in a very reliable form. The necessity of such data is equally great elsewhere in India. This is therefore a task awaiting the services of preferably the University men who may thus fulfil a very great need of their place.

Original Articles

CANNING AND BOTTLING OF FRUITS AND VEGETABLES

By Dr. V. G. Vaidya, B. Ag.; Ph. D. (Bristol)

(Assistant Professor of Agriculture, College of Agriculture, Nagpur.)

Canning of fruits and vegetables has been very recently introduced in India. Of late people have begun to acquire taste for canned products and there is a growing demand for canned fruits and fruit salad. Moreover people relish a variety of dishes on the dinner table and like to eat fruits and vegetables out of season and those which are grown in different places. The import figures for fruits and fruit products show that India imports every year fresh, canned and dried fruits to the extent of Rs. 1,00,00,000. On scrutinising the demand for canned fruits it is found that canned peaches, pears and fruit salad, because of their high price are mostly consumed by richer class of people, while canned pineapple whose cost is appreciably low has found a market among middle class people as well. Reducing the cost of canning is, therefore, the only way of making canned products an article of diet rather than of luxury.

Canning of fruit on domestic or semi commercial scale is in its infancy in India and the art of canning is practically unknown to most of the people. Canning of Indian fruits like mango, guava, litchi (Nephelium litchi) and pineapple has great prospects, as these fruits are peculiar to India and may acquire a world-wide demand. The British Industries Fair at London in 1938 has shown great hopes for canned mango of good quality. Fruit and vegetable canning, therefore, should be properly developed and for its success attention should also be paid to

the problem of containers and the availability of uniform quality fruit for canning.

Problem of containers.—The industry of manufacturing containers goes side by side with the canning industry. At present most of the tin cans required in canning are imported from outside and this unnecessarily increases the price of the canned product. There has been a great revolution in canning industry since the introduction of double seamed cans. Prior to about 1903 the cans were of the type known as "Solder top" or "Hole and Cap" cans (Fig 1). The aperture in the can was small, making it difficult to put the fruit into the can. Much of the fruit was lacerated. On filling the can with fruit and sugar syrup a disc with a small vent hole was placed over the opening and soldered to the top of the can. After preliminary heating to expel the air the vent hole was sealed with drop of solder. The can was then sterilized in boiling water. The art of soldering and the process of canning were rather difficult for unskilled persons and canning did not achieve much popularity. Moreover the principles of sterlization were not properly understood and the inner contents in many cases were soft due to over boiling and did not keep their natural flavour. Some sugar was carbonised while soldering and formed black specks in the syrup.

Double seamed cans also known as "Open-top" or "Sanitary cans" (Fig 1) have now almost entirely replaced the solder top cans. The advantages of this type of cans over the solder top are (i) that the diameter of the opening is equal to that of the can body and hence fruits can be packed into the can without laceration or crushing, (ii) that neither solder nor heat are used in sealing the lid to the can and consequently carbonsing of the syrup is avoided and (iii) that the whole process of canning has been simplified and has become more sanitary.

The cans used for fruit and vegetable preservation are made of high grade iron plates coated with tin. The tin sheets are carefully examined and the defective ones are sorted out and recoated with tin so that the organic acids do not come in contact with iron. The tin plate which consists of about 98 per cent iron and 2 per cent tin has a white lustrous appearance and is quite suitable for canning fruits like mangoes, peaches etc. Highly coloured fruits like berries get bleached in plain tin cans and hence they are packed in lacquered cans. Fruits of high acidity are packed in "double lacquered" or "Acid Resistant" cans. Vegetables are packed in cans having different type of lacquer known as "Sulphur Resistant" cans.

The ends of the can are fastened to the can body by a double seaming operation and an air tight seal is made by a lining of rubber between the

end and the body of the can. Cans are obtained in various sizes. The most common ones are given in the following table with their approximate capacity.

Code name	Diameter in inches	Length in inches	Capacity in ccs.
Picnic	$2\frac{11}{16}$	$3\frac{2}{16}$	240
English	$3\frac{1}{16}$	4	395
American	$3\frac{7}{16}$	$4\frac{8}{16}$	580
A 2½	$4\frac{1}{16}$	$4\frac{11}{16}$	850
A 10 or gallon cans	$6\frac{3}{16}$	$6\frac{15}{16}$	3050

Can seaming machine.—The ends of the can are sealed to the can body by a can seaming machine without the use of solder. It is done on commercial scale by power seamers which work at the rate of 30 to 60 cans per minute and on domestic scale by a hand machine (Fig. 2) doing 3 to 5 cans per minute. Hand seamers are of several makes but a Dixie hand sealer of American make is very serviceable. It costs about Rs. 100/- and small growers who want to undertake this enterprise can use this machine without much training. It can seal A 2½ cans. The following description of the process of fastening the lid to the can, adopted from bulletin No. 21 of the Ministry of Agriculture and Fisheries, England will be found useful.

"The camlever (A) is adjusted so that the bottom plate (B) is in its lowest position. The filled can with loose end fitted in position is placed on the bottom plate (B) which is then raised by turning the cam lever (A) to the fullest extent when it will be found to lock. In this position the Chuck (C) fits into the recess in the cover and clamps it firmly into position on the can. The correct position of the can on the bottom plate is determined by the locating bracket. The can having been locked in position, is revolved by turning the handle (D) of the machine with the right hand in clockwise direction. This handle should be revolved as rapidly as is conveniently possible. As soon as the tin is revolving the operating lever (E) is pushed away from the operator with left hand until the first operation roller presses gently against the edge of the cover. Pressure should then be applied steadily and firmly. But not too quickly, and should be continued until the roller stop comes up against the

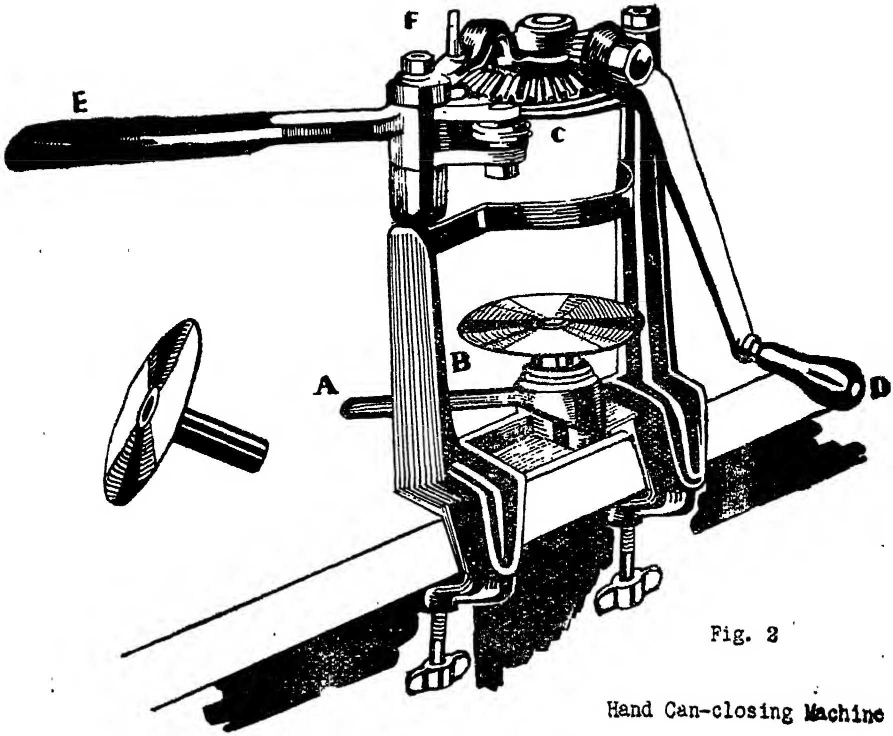

Fig. 2

Hand Can-closing Machine

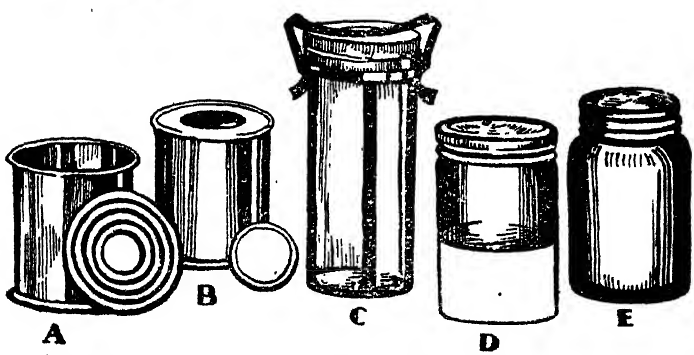

Fig. 1 - (a) Sanitary Can, (b) Hole and cap can.
(c) Clip bottle (d) Screwband bottle
(e) Jam jar

machine stop (F), when the first operation is complete. If the operation has been performed to perfection a steady application of pressure should bring the stops together in about twenty four revolutions of the handle. The operating lever (E) is then pulled towards the operator until the second operation roller is brought into contact with the edge of the can. Pressure is again applied whilst the handle (D) is turned until the second roller stop comes up against the machine stop (F) when the seaming is completed. A steady pressure is desirable in the second operation, but it is not so necessary as in the first, since the first operation forms the seam and the second merely flattens and compresses it. As it is most important that the seam should be evenly formed and lightened all round, the can should in both operations be revolved several times after the roller stop appears to have gone up against the machine stop." The actual seaming is carried by two small rollers as shown in figures 3, 4 and 5.

In figure 3 the first operation roller will be seen adjacent to the can.

Figure 4 shows the can and lid after the first operation has been completed and before the roller has been withdrawn. It will be noticed that the edge of the lid has been rolled round and under the edge of the can. In order to secure a good result the first operation roller must be brought in very slowly.

In figure 5 the second roller has completed its work but has not yet been withdrawn. It is of great importance that the first operation roller should complete its work before the second roller is brought into play, otherwise a faulty seal will result.

Principle of preservation used.—The principle of preservation used in canning is efficient sterilization of the contents of the can by heat. A fruit has Yeast cells and spores of moulds upon its surface. Bacteria are rarely found as the acidity of the fruit checks their developement. The enzymes are present in the fruit and bring about ripening changes. Preservation of fruit in can is therefore, mainly concerned with killing them and preventing their access again into the can. This is attained by sterilizing the can in boiling water after sealing it airtight. The time for which a can has to be boiled will differ with the type of fruit, hard fruit requiring more time as compared with the soft fruit. As the cans are closed completely before sterlization no micro-organisms can enter after the cans are sterilized by heating.

In bottling fruits the principle of sterlization is the same but the technique differs slightly as the glass containers cannot be put directly into boiling water. The temperature there has to be raised or lowered slowly.

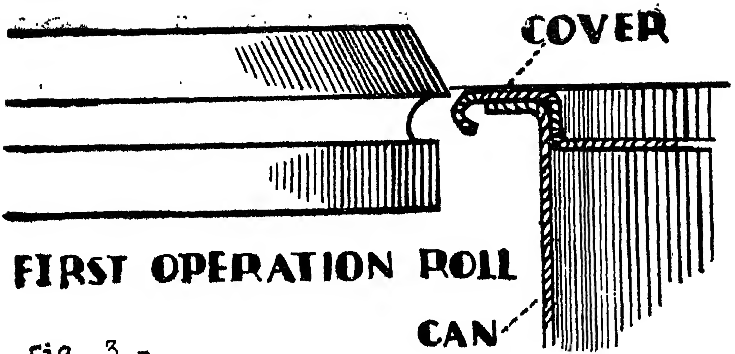

Fig. 3 -

First Operation Roll Adjacent to Can.

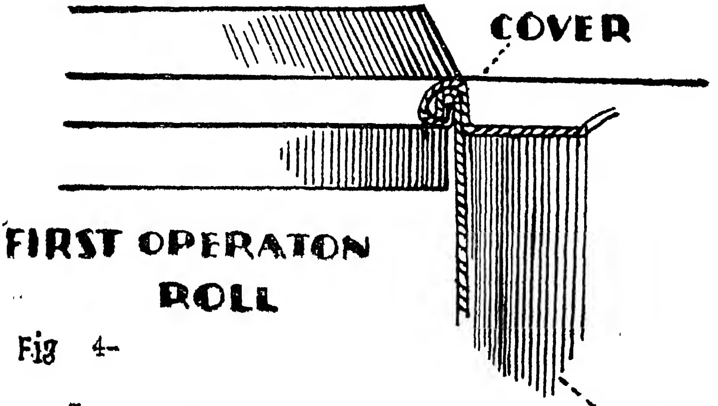

Fig 4-

First Operation Roll Completed.

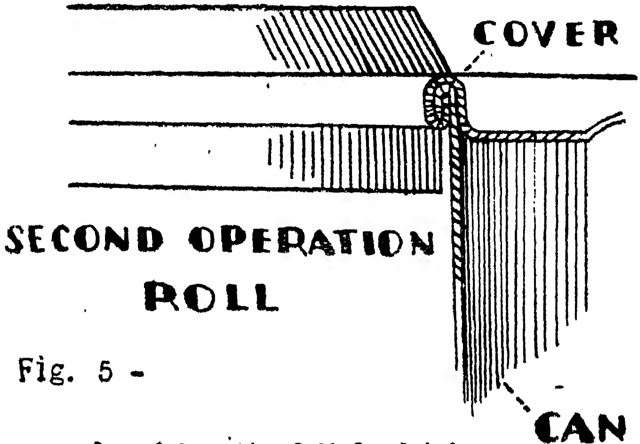

Fig. 5 -

Second Operation Roll Completed.

The problem of canning vegetables is slightly different. Fruits invariably contain organic acids which help sterlization but vegetables contain very little or no acid at all. Moreover many vegetables grow in soil, while others are contaminated by it. The soil bacteria are therefore, always present upon the surface of the vegetables and the spores of some of these are very resistant to heat and may stand the ordinary boiling temperature for two hours or longer. When vegetables are preserved at the same temperature as in case of fruit and stocked for some time spores may develop and decompose the vegetables. It is therefore, essential to sterilize the cans under pressure, in pressure cookers or autoclaves at 240°F for about 30-40 minutes. This temperature is quite sufficient to kill any spore form. It is necessary to observe thorough cleanliness in removing all traces of soil from the vegetables so as to ensure successful preservation. Citric acid and common salt are also usually added to help sterilization of vegetables.

An alternative method is intermittent sterilization. The cans are processed in boiling water for about an hour and then taken out and cooled. This process is repeated on the second and third day. The first destroys most of the vegetative bacteria and during the twentyfour hours which elapse spores which have not been killed may germinate. The second sterilization destroys these cells and kills the bacteria which were not destroyed originally. Any spores which may have survived the first and second sterilization are destroyed during the third operation.

Equipment for canning.—Very little apparatus is required for the process of canning. This includes two aluminium pans, spoons, two open water baths with false bottom, a balance, thermometer, a Brix hydrometer, cans and a can seaming machine. Most of the material could be had locally and the whole outfit on a small scale should not cost more than Rs. 200/-. It can do about 100—200 cans in a day. If vegetables are to be canned a small autoclave costing about Rs. 125/- should be purchased.

Sequence of Processes in Canning Fruits

(1) Selection and preparation of fruit.—Sound and firm ripe fruits should always be selected for canning. Over ripe, bruised fruits do not give good appearance and spoil the flavour of the finished product. Similarly under-ripe fruits give a raw taste and possess very little flavour. The fruits should be graded for size and uniformity of ripeness and colour so as to make a first class product. Inferior fruit should not be mixed with sound fruit. Usually very small and very big fruits are unsuitable for canning. The fruits after grading are washed in clean water and their

stalks and calyces removed. Some fruits like peach, orange, grape fruit etc are lye-peeled so that the segments can be easily peeled off. Usually a solution of caustic soda of 1—2 per cent strength is prepared and boiled. The segments of oranges or whole peaches are immersed in it for about ninety seconds and are then taken out and washed thrice with clean water. The alkali should be washed off completely otherwise it will darken the can.

(2) **Packing fruit into cans.**—Cans coated with acid resisting lacquer are used for fruits having water soluble colour like Jamun (Eugenia jambolana) but fruits like mango, litchi, guava and pineapple are packed in plain cans. The fruits are peeled by hand and cut into equal sized segments and packed into clean cans to within one eighth inch of the top. Usually bruising the fruit should be avoided and definite weight should be put into each can.

(3) **Sugar syrup to cover fruit.**—Fruits could be preserved satisfactorily in water but much better results are obtained by using a sugar solution as a covering liquid. Sugar syrup helps to retain the fresh fruit flavour and maintains the colour of the product.

The strength of the sugar syrup used varies according to the variety and sweetness of the fruit, acid fruits requiring more concentrated syrup than others. The amount of sugar present in the syrup can be determined with the aid of a Brix hydrometer. For practical use the following table will be useful.

Degrees Brix 68°F	lbs. of sugar to be added to each gallon of water	Volume of syrup from one gallon of water	Weight of sugar contained in one gallon of syrup
25°	3.34	1.208	2.76
30	4.30	1.269	3.38
35	5.40	1.338	4.03
38	6.14	1.384	4.44
40	6.69	1.419	4.71
42	7.26	1.454	4.99
45	8.20	1.514	5.42
50	10.03	1.628	6.16
55	12.26	1.770	6.93
60	15.05	1.948	6.73

The syrup should be made in soft water because the hard water has a tendency to make the syrup cloudy. It should be filtered through a muslin cloth. The syrup should be heated to 170° F and filled into the can to within $\frac{1}{16}$th of an inch.

(4) **Exhausting or removal of air from can and its contents.**—The cans filled with fruit and sugar syrup are placed in hot water before sealing the lid. The cans are dipped to within one inch of their top end and kept for about six minutes at 185° F. The object of this process which is commonly known as exhausting is to remove the air from the contents of the can and thereby reduce corrosion of the tin plate, since corrosion is favoured by the presence of oxygen. It produces a vacuum and the ends of the can are drawn in. Convex and bulged cans usually indicate gaseous spoilage. Another important object is to prevent undue strain upon the ends during sterilization.

(5) **Lidding and sealing cans.**—The cans are taken out, lids put on them and sealed over a seaming machine as described already. The inner contents are then sealed airtight and now remain to be sterilized.

(6) **Processing.**—The sealed cans are placed in boiling water for about twelve to fifteen minutes. The time of heating will vary according to the size of can, the type of fruit and the method of packing. Heat should penetrate to the centre of the can and sterilize the contents in the centre. Heat is conveyed by conduction and convection currents set up by sugar solution. It is therefore, essential to shake the cans gently at intervals. A tightly packed can of fruit will be heated much more slowly than a loosely packed one, and hence the fruits should never be packed very tightly. Mango pulp will take much longer time to be sterilized than mango slices in sugar syrup. Filling the cans with hot syrup and exhausting at 185°F helps much in the proper penetration of heat and complete sterilization of the can. During processing the ends bulge out due to the expansion of the inner liquid.

(7) **Cooling and storage.**—The cans are taken out and are immediately put in cold water and kept there till they are completely cooled. The bulged ends are again drawn in due to the shrinkage of inner contents and partial vacuum. The cans are then wiped dry and stored in a cool place.

If the contents go bad within about a week the ends bulge out and the reason is that either the cans are under sterilized or what is more likely a faulty seam through which the micro-organisms gained access to the fruit after sterilization. The proportion of faulty seals should however be very small and should never exceed one per cent. The cans whose ends are drawn in and give a clear sound on knocking with finger are in good condition.

Directions for canning different fruits.—Detailed instructions are given below for canning mango, guava, pineapple, litchi and mandarin oranges.

Mango.—(Mangifera indica) Mango can be canned as slices or in the form of pulp. Pairi, Alphonso, Safeda, Dasheri and Langra varieties are

suitable for canning. Fazri and Neelum do not give very satisfactory results as they possess fibre in the flesh and are soft at the stone. The fruits are best canned firm ripe but they should not be immature. Over ripe mangoes disintegrate and soften badly during sterilization. They are washed in clean water and peeled by hand. There is no machinery for this process and it requires a certain amount of skill to peel the fruit uniformly by hand. They are then cut into uniform slices by means of a sharp knife and filled in plain cans. The slices are covered by 45° Brix sugar syrup at 170° F. The cans are exhausted for six minutes in an open water bath having false bottom and containing water at 185° F. The water should be kept within an inch of the top of the cans. They are then taken out and sealed over the seaming machine as previously described. The sealed cans are sterlized in another open water bath containing boiling water for fifteen minutes. The cans are then taken out and dipped in cold water till they are completely cooled. They are then finally dried and stored in a cool place.

Mango pulp.—The stones after slicing the fruit are passed through a hand pulper to extract pulp. Soft fruits are utilised for extraction of pulp. The pulp is strained through a muslin cloth to get rid of any bits of skin or fibre. It is then heated to 170°F and filled hot in cans leaving a clear head space of half an inch. The cans are exhausted for six minutes at 185°F and sealed on a seaming machine. They are then sterilised for twenty five minutes in boiling water. The cans are cooled in cold water and stored in a cool place.

Guava.—(Psidium Guyava) Guavas are obtainable very cheap. There are several varieties but none of them are seedless. The Allahabad and Takhatpur guavas are tasty. Firm ripe fruits should be selected for canning, washed in clean water and lye-peeled in 1 per cent caustic soda at boiling temperature for 30 seconds. This dissolves the peel and then the fruit should be washed thrice with clean water to remove any traces of caustic soda. Guavas are then cut into quarters and the central portion containing seed is removed by a sharp spoon. Cut fruit soon turns brownish through oxidization and hence it should be kept in 2 per cent brine solution until required for filling. The quarters are filled in can and covered with 40° Brix syrup at 170° F leaving a head space of one fourth inch. The can is exhausted for six minutes at 185° F and then sealed. It is then sterilized in boiling water for fifteen minutes, then cooled and stored in a cool place.

Pineapple.—(Ananassa sativa) Canned pineapple is really a delicacy and has become very popular in India. Pineapples for canning are picked when fully ripe and they are handled carefully to avoid bruising.

They are then peeled, cored and are cut into equal sizes. When on a commercial scale a 'Geneca' machine is used and it automatically peels, cores, sizes and cuts off the ends. A slicing machine then cuts it into rings of equal thickness. The slices are filled in cans and covered with 35° Brix syrup at 170° F, exhausted for four minutes at 200° F and sterilized for fifteen minutes in boiling water. The cans are cooled and stored in a cool place.

Litchi.—(Nephelium litchi) Litchi is a delicate fruit with fine flavour. Muzaffarpur and Dehradun litchis are sold fresh in U. P. markets but as the fruit does not keep long it cannot be sold in the distant markets of other provinces. The season for litchis does not last for more than a month and if the fruit is preserved it will have a great demand out of season. Canned chinese litchis are sold in Indian markets.

Litchi should be peeled carefully to avoid bruising. The peduncle is given a twist and then taken out. The hard coat is then cracked into two and taken out gently. The inner seed is not removed as the fruit loses it shape. The peeled fruit has white round appearance. It is filled in can and covered with 45° Brix at 170°F. The cans are exhausted for five minutes at 185° F and sterilized for 15 minutes. They are then cooled and stored in a cool place.

Mandarin oranges.—Medium sized oranges with nine segments are preferred. Canned mandarins from Japan are sold in all markets and have a wonderful flavour. The Mandarins are peeled without blanching in hot water and the fibres sticking around then are removed. The peeled fruit is placed in crates and left for a period of 10-30 minutes in a current of air in the shade. Immediately as the mandarins are dry they are divided into individual segments and these are placed in water to prevent skrinkage. The segments are then lye-peeled in 2 per cent caustic soda solution for 90 seconds at 175°F. The white skin covering the segments changes to yellow by alkali treatment. This is followed by three thorough washings in cold water to remove all the alkali. Any skin adhering on the sides may be removed by a sharp knife. Difficulty is occasionally experienced in removing the white fibre from the back of the segments and to overcome it the segments are soaked 3—4 hours in a weak solution of acid of about 0.5 per cent strength as a preliminary step to the alkali treatment. The segments are then graded into large, medium and small. The damaged ones are rejected. They are again washed in water and immediately filled into cans and covered with 45°Brix syrup at 185°F. The cans are exhausted for 10 minutes at 185°F and sterilized for twenty minutes at 200°F. They are then cooled in cold water and stored in a cool place.

Bottling of fruits.—For home consumption glass containers are more economical than tin cans as the former can be used over again and will last for years if handled carefully. The product looks more attractive and keeps in finer condition. There are no chances of fruit being spoiled due to action of fruit acids on tin plate. Tin cans are given preference in commercial canning as the glass containers have the following disadvantages :—(1) There is more chance of breakage either in the process of sterilization or in cooling after sterilization, (2) They cannot be at once dipped in boiling water, (3) Storing and transportation are more difficult, (4) The prices are comparatively higher.

The glass containers used for bottling are of two types (i) Clip bottles and (ii) Screw hand bottles (Fig. 1). Both the types can be obtained in different sizes and with aluminium or lacquered tin lids. Clip bottles give more consistent results than screw band bottles as in the latter type the bands are apt to stretch somewhat after use and unless care is taken to select a band which fits a bottle there is always a danger of faulty sealing. The rubber rings are always inserted between the bottle and the lid. They should not be used more than once. If these two types of bottles are not available ordinarily wide-necked bottles or jam jars with tight fitting corks may be used.

The bottles should be washed in warm water, rinsed with cold water and allowed to drain. The fruits should be packed as tightly as possible without crushing them and the bottle must be well filled. As the fruit is visible from outside special attention should be paid to grading and uniformity of slices. Litches should be arranged in bottles to allow as large a quantity as possible to be put in. Water may be used as a covering liquid but much better flavoured product will be obtained on using sugar syrup. The strength of sugar syrup to be added is the same as for canning but it should be added in cold or warm state.

The next operation consists in putting on the rubber ring, lid and clip or screw band. The latter should not be screwed down tightly before sterilizing as the lid should be loose to allow air and steam to escape. The bottles are then sterilized in an open water bath having a false bottom and containing water to within two inches of the top of the bottles. The temperature of the water should be raised very slowly to 145°F in first hour and 190°F in next half an hour, a thermometer which registers not less than 212°F is very convenient for this purpose. The bottles are then allowed to remain at that temperature for 15—20 minutes and then taken out by means of bottle tongs or dry cloth. If screw band bottles are used screws are tightened as soon as each bottle is taken out. If ordinary bottles or jam jars are used they are removed one at a time and

sealed as quickly as possible by tight fitting corks. The corks should first be thoroughly heated in boiling water otherwise they will cause the fruit to become mouldy. After the hot corks are driven in, melted wax should be poured on the top to make them air-tight. The bottles are then placed on wooden table for cooling. When they are properly cooled the clips and screw bands should be removed and each bottle should be carefully tested by the lid. If the lid remains firm there is a good vacuum and the fruit will keep. If the lid comes off there is a flaw in the rim of the bottle or where it fits on the rubber ring. The flaw should be found and remedied and the bottles may be sterilized again as before.

Canning of vegetables.—All vegetables available in the market could be canned. This subject has not received much attention as fresh vegetables are available all the year round in Indian markets. Canned vegetables are, therefore, not much in demand. Green peas, green gram, Parwal (Tricosanthes dioecia) etc. which are rather delicacies among vegetables grown in India, if canned and supplied out of season may have good demand.

Preparation of vegetables for canning is the most important process in canning them. They should be washed so as to be free from all traces of soil and in some cases also washed in dilute solution of potassium permanganate and then should be peeled, scraped etc. according to their kind. They are tied in muslin cloth and dipped in boiling water or blanched as it is termed for two to five minutes. Blanching, softens, shrinks and drives a great deal of air from them. After removing from boiling water they should be plunged at once into cold water for a few minutes to make them more easy to be handled while packing.

Vegetables are packed rather loosely into sulphur resistant cans and covered with a hot solution of brine at 180° F. The brine solution contains the follwing ingradionts per gallon of water—2 ozs of good quality salt free from dirt, 8 ozs of clean white sugar and 6·8 c.c. of vegetable green colour known as H. P. G. The cans are exhausted for 6 minutes at 185° F and then sealed on a seaming machine.

The cans are sterilized in an autoclave for 30—40 minutes at 240° F. An autoclave is generally made of strong cast iron or aluminium and has tight fitting lid which can be clamped on so firmly that the vessel is made steam tight. On the top of the vessel is a pressure gauge and a safety value. As the pressure inside the vessel rises the temperature of the steam also rises so that when the pressure gauge registers 10 lbs pressure the temperature is 240° F. It is usual to raise the cans to this temperature in fifteen minutes, leave them at the full sterilization temperature for 30—40 minutes and them blow off the pressure in the autoclave in

ten minutes. The cans are then removed from the autoclave allowed to cool for a few minutes in air and then immersed in cold water. They are then wiped dry and stored in a cool place.

In the absence of autoclave intermittent sterilization may be followed. The cans are placed in an open water bath containing boiling water and allowed to boil for one hour and then cooled in cold water. On the following day they should again be boiled and subsequently cooled and this process is repeated on the third day to ensure complete sterilization.

If vegetables are bottled five ozs. of lemon juice per gallon of brine solution may be added and intermittent sterilization method should be followed.

Green peas.—(Pisum sativum) As the pods are often very dirty it is most important to wash them very thoroughly before shelling. The pods should be washed in clean water or preferably in dilute solution of potassium permanganate. The peas are shelled, graded and tied loosely in muslin cloth. They are blanched in boiling water from one to two minutes according to the size of the peas and then taken out and placed in cold water for a few minutes. The sound peas are filled in not too tightly in sulphur resistant cans to within half inch of the top and covered with boiling brine solution. The cans are exhausted for six minutes at 185°F, sealed and sterilized in an autoclave at 240°F, for 30-40 minutes. Cans are cooled and stored in a cool place.

Green gram (Cicer arietinum).—The pods should be shelled and green gram should be washed in clean water. The rest of the method is the same as for peas.

Parwal (Tricosanthes dioecia).—Parwals are washed in clean water and stalks and blossom ends are removed. This is generally referred to as topping and tailing. The outer skin may be peeled and then they are blanched in boiling water for three to five minutes and dipped in cold water. The rest of the process is the same as for peas.

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Wound may be defined as external, open or exposed rupture of the tissues of the animal body produced by violence. An injury of the large and deeper parts, without a corresponding injury to the epidermis and dermis is known as a bruise, contusion, internal, closed, subcutaneous or interstitial wound. A wound is composed of a wall and contents. Contents differ according to the nature of the injury. They may contain tissues, debris and blood clots or layer of damaged or destroyed tissue mixed with extravasated blood, lymph urine etc or foreign matter. The wall of the wound contains three zones such as (i) a central zone of dead tissue varying in thickness but always present. It may be so thin that it is imperceptible and insufficient to interfere with the first healing of an open wound or it may involve structures of great depth and end in gangrene, (ii) Stupefied zone surrounding No. (i) in which the tissues are reduced in vitality and are likely to die. (iii). A zone of reaction surrounding No. (ii) characterised by acute inflammation, and actively employed in bringing about repair of the injury.

Wounds are of great importance among the most common disordered conditions from which domesticated animals suffer. On account of their common and frequent *occurences* they are rather neglected with an idea of a minor malady, and sufficient care and trouble are not taken by owners and attendants of animals in their treatment. This is only concerned to circumstances connected with cleanliness, which is all essential for early healing of a wound in such a way that no serious blemish in the form of a scar shall remain afterwards. While using dressings a good deal of misunderstanding exists as to the strength of antiseptic applications which are useful for wounds; many think that the stronger the antiseptic more certainly will infectious germs be killed, but they forget the fact that as antiseptics are increased in strength, there comes a time when they will not only kill the germs but will kill the living tissue cells of the wounded part, which are the active agents of repair. This causes a greater destruction of tissue, consequently prolongs the healing period.

Varieties.—Wounds may be classifind according to the nature of the effect produced such as Incised, Punctured, Lacerated, Contused, Gunshot, Poisoned, Envenomed, and Granulaitng wounds.

Incised wounds.—Are usually caused by some sharp instrument which leaves a clean cut; the tissues are simply divided without extensive damage to the surrounding parts. Bleeding from an incised wound is likely to be very profuse for a short period, but it soon stops and is easily controlled.

Punctured wounds.—Or stabs are cause by pointed instruments. These wounds are most dangerous for animals, because not only may they involve some deeply seated organ or tissue, but bleeding from them is very difficult to check, the provision for drainage is difficult, and they always heal over the surface portion of the wound, thereby dangerous germs are concealed. It is on account of the latter reason that a healed wound at times bursts open again and discharges large quantities of pus; more over tetanus is much more likely to become a further complication where the bacilli have been enclosed below the healed skin for some period, than where the wound has remained open to the action of the oxygen of the air. The wounds produced by the horn of an ox, by the points of reaping *machine*, by the canine teeth of dogs, by the bullet etc. are all punctured wounds, and should be considered serious.

Lacerated wounds.—Are caused by barbed wire fencing in which great tearing takes place. They are usually very painful for a few days but owing to the very great nature of the injury drainage is generally good and the wounds heal up satisfactorily. These wounds at times do not bleed, owing to the lacerating and twisting of the blood vessels that has occurred. Such wounds possess damaged tissues and hence suppurate before they heal leaving behind extensive bad scars.

Contused wounds.—Are caused by blows from heavy articles, kicks from shod animals and from falls. There is much brusing of the surrounding tissues. There may not be bleeding from the wound, but blood may be extravasated into the tissues round about its edge and healing is rather slow.

Any wound may become infected with pus forming organisms and turn into a suppurating, septic or poisoned wound. Majority of animal wounds become infected and suppurate on account of the pieces of debris from the skin, hair etc. are almost always carried into the underlying tissues by that thing which causes the wound. There are two kinds of suppuration, such as 'healthy suppuration' in which pus formed is thick, white or only slightly yellow, creamy and having no bad smell; 'unhealthy suppuration' is thin yellowish or blood stained, sticky and possessing bad smell.

First aid treatment.—It has to be left to the discretion of the individual, as much depends upon the type of animal, its temperament, and circumstances under which the wound is caused and the nature of the wound. Generally the first aid should consist of securing the animal and preventing it from doing itself further injury. Arresting bleeding, cleansing the wound and applying dressing, bandages etc; and keeping the animal quiet until the blood clots in the mouths of the injured arteries.

Securing.—If the animal has become injured, while working it should be stopped from working. If it has fallen while in yoke, it must be released and the cart must be drawn back before the animal is allowed to rise. Cattle are secured by throwing a rope over their horns or round their necks pulling to a post. A pair of bull-holders are fixed into the nostrils of such animals having no nose strings, or the animal is simply held by the nose by an assistant.

An injured bullock will not allow to dress a large painful wound unless it is thrown, so it is sometimes necessary to cast an injured bullock. Sheep and such small animals are held by an assistant, with or without their legs tied.

Arresting bleeding—Before trying to arrest bleeding the animal should be controlled as described above but care should be taken to keep the wounded part within an easy reach. If the bleeding can be stopped by applying direct pressure it should be done in the following manner. A cleansed finger or thumb should be applied over the bleeding point. This is only a temporary measure. A swab of cotton wool soaked in clean water or saline solution should be pressed well into the depths of the wound, held there for a few seconds, and then removed. In some cases a swab of dry cotton wool introduced into a wound will cause blood to clot and the bleeding is checked. If the cotton wool is clean, this may be left in position, because if it is carelessly removed, the clot is disturbed and the bleeding proceeds. Other things which can be used for applying direct pressure are, a handkerchief or a piece of other fibric, a bunch of sheeps' wool or other convenient material may be used to induce clotting but such substances must be made antiseptic in order to prevent infective germs entering into the wound. Such substances should be used in an emergency when other substances are not at hand.

Bleeding can be stopped by applying indirect pressure. This will block the artery or arteries which supply the bleeding part of limbs only with blood. Tourniquet is the most effective in cheking haemorrhage in this way. In case if there is no tourniquet, a piece of soft rope, a long

bandage, a rolled up handkerchief, a boot lace, piece of string etc should be used. A loop should be formed around the limb above the wound, and twisted up tight enough to stop the circulation. A closed knife, piece of wood, large key, walking stick handle or other short piece of wood or metal should be used to twist the loop tight. To make this method more effective a pad of some fairly hard substance should be placed above the artery and below the loop of the tourniquet before twisting.

Another form of pressure is employed during surgical operations through the medium of a forceps called an "artery forceps". These are used to catch the end of a bleeding vessel, and either by crushing or twisting damage the cells of the wall so that the round interior portion of the vessel is blocked and the bleeding is stopped. If the blood vessel is too large it is necessary to tie its cut end. While tying the artery is seized as before with the artery forceps, and a loop of antiseptic silk, catgut, or thread is slipped over the handles of the forceps; the end of the vessel is slightly pulled out from the surrounding tissues, the loop is placed round it and pulled tight; for this purpose the surgeons' knot is used, as it does not loosen with the elasticity of the wall. After giving such two knots, the vessel should be released after the ends of the ligature have been cut short.

In many cases bleeding can be controlled by the application of Styptic medicines such as strong solution of common salt in water, turpentine, alum either as a 10 to 20 per cent solution, or as dry dusting powder, 1 part of alum in 4 or 5 parts of starch, copper sulphate, tincture of ferri perchloride and compound tincture of benzoin etc. The application of either cold or hot water to a bleeding wound will check the haemorrhage from smaller vessels and capillaries. In both the cases the water should be as clean as circumstances will allow, so that fresh germs may not enter into the wounds. Luke warm water has a tendency to increase the bleeding than before, so it is necessary that the water be either definitely hot or definitely cold. Of the two cold water acts best, and when obtainable ice in small pieces is better than either.

Actual cautery i. e. burning with an iron heated to a dull red, is an excellent styptic, but it has the disadvantage that it destroys much tissues on the surface of the wound and it causes a great deal of pain. It is chiefly useful when the bleeding is from surfaces where artery or vein is situated in or surrounded by harder tissue such as bones, cartilage, or horn. It is used to stop bleeding from broken off horn core, from an injury to sensitive part of the foot, from the tail after docking and in certain methods of castrations.

It sometimes happens that the actual point or points of bleeding cannot be located especially when the wound is deep and the blood comes out in a continuous stream showing no tendency to clot. In such cases it is necessary to use packing for the wounds—inserting such one or more, —and the wound should be stitched to hold the packing in position. For this purpose the packing is of gauze, cotton-wool, or tow but whichever is used it should always be boiled ten minutes before insertion so that the germs may be killed. If available some one or other of the antiseptic gauzes is better, as there is no danger of these conveying infection into the wound. The material selected is made into swabs of a convenient size, and these are pressed into the depths of the cavity. One or two stitches are inserted through the edges of the skin and brought fairly tight. The packing is allowed to remain in position for two days or more; should it be disturbed earlier there is a risk that clots which form in cut ends of the vessels may be disturbed *and the bleeding start.* When this method is employed it is necessary to see that all the packing material is taken out of the wound before it starts to heal up, for if any small pieces be left they will cause suppuration and interfere with the closing of the wound cavity.

Cleansing of the wound.—Owing to the covering of hair on the bodies of the domestic animals it is practically impossible to clean a wounded part in as satisfactory manner as in man. The thing which causes a wound carries hair, skin debris and other matter in to the cavity of the wound and it is not possible to remove these materials completely. The larger portions of foreign matter should be picked out as gently as possible with a pair of antiseptic forceps. Where a large object such as a piece of pointed wood from a fence, has penetrated and is still present it should be withdrawn if it will come away without causing too much pain. A rush of blood usually accompanies the withdrawal of foreign bodies from a wound, partly due to unavoidable tearing of the tissues, and partly to the reduction of pressure upon the cut arteries. The hair around the edges of the wound, along with any lacerated portions of skin or other tissue, should be clipped away with a sharp probe pointed scissors, the cavity of the wound having previously been packed with cotton-wool to prevent further contamination of the raw surface. Finally the surface of the skin around the area is washed with water containing lysol or other antiseptic. If the wound is in such a part as can be bandaged a dressing of antiseptic dusting powder or swab soaked in a solution of acriflourine, potassium permangnate, weak tincture of iodine, or common salt, should be applied, and protective bandage fixed over all. It is always advisable to use a layer of cotton-wool over the wound, so

that pressure may be as evenly distributed as possible, and so that any bleeding may check itself by coagulation in the meshes of cotton-wool. If accident occurs near a cold water tap such water should be used for cleansing the wound, a gentle stream of water from hose-pipe should be allowed to runover the wounded part, if greater force is used the water will hinder coagulation of blood and bleeding may not be stopped.

In the absense of all other dreassing, tincture of iodine should be freely used over the injured area and around it. Many of the ordinary accidental wounds of domestic animals turned into septic condition through contamination can be kept far cleaner, and would heal up in less time if a bottle of tincture of iodine ($2\frac{1}{2}$ per cent strength) is kept in a cattle shed with directions to attendant to use it upon wounds immediately after such are caused.

Afterwards the animal should be kept as quiet as possible so that the blood in the mouths of arteries may have a proper chance to clot. For this purpose it is better to give the animal a small feed and leave it by itself. If the animal is not too badly injured it will certainly start feeding and remain quiet so long as the food lasts. At times it will be necessary to use some restraints to prevent an animal from licking, biting, or scratching at a wounded part. If the bandage is comfortable, and if the bleeding has been stopped or almost stopped the wound may not require any attention till next day, but in case where a large open wound has been caused it is usually advisable to draw the edges together to some extent by suturing. Where it becomes necessary for the untrained owner of an animal to give sutures, it should be remembered that (i) the animal should be properly controlled, (ii) the materials for use should be perfectly boiled and the hands carefully washed, (iii) the needle should be inserted first into the edges of the skin which is far away from the central nervous system; and (iv) as few sutures should be used as will gain the desired end of bringing the edges of the wound together, and they should not be applied too tightly, so they may not cut through the skin or prevent the escape of discharges.

Healing of wounds by first intention.—In a clean cut wound which is made during antiseptic operations, the immediate effect is bleeding from the ends of vessels which have been cut. A small quantity of blood remains between the divided edges and clots. The blood vessels round the cut edges dilate, the blood flow is decreased, lymph passes out from the blood, coagulates upon the surface of the wound forming a sticky layer of fibrin which, if the injured surfaces are in contact, causes them to stick to one another. White blood corpuscles pass out from the dilated blood

vessels and roam about this exudate in the wound. These white blood corpuscles absorb and destroy any foreign or dead substances which have to be removed in order to allow the process of healing in progress. Within 24 hours multiplication of cells starts and this is changed into a delicate net work of fibrous tissue. Simultaneouly with the formation of this net work minute buds shoot from the capillaries at the edges of the wound and form small blood channels, which pass from side to side of a wound to form loops where the distance across the wound is large. The tissue so formed is now called 'granulation tissue' as this has got a red granular appearance. Along with this healing process, epithelial cells from the skin begin to grow over and cover the wound, the whole process being completed in about a week, where the skin edges have been accurately united. In such a case if the part is covered by hair no new hair follicles are formed, but the scar marking the line of cut is so thin that hairs from each side of the wound grow across it and hide it. It is still possible to know the situation of such a scar if the hair be rubbed the wrong way, or if the skin surface be clipped close. The delicate tissue of the newly healed wound is gradually replaced by denser, firmer, fibrous tissue, until in a few months the healed wound is only represented by a thin line like visible scar.

Healing by second intention.—Such healing takes place where the granulation tissue remains exposed to view. It occurs in wounds which have broken down owing to suppuration, where there is an ulcer, where a large area of skin has been removed, or has sloughed off without poisoning, and in other cases. A larger, wider, and more noticeable scar remains after healing. This is the most common method of healing of wounds among animals.

Healing by scab formation.—Such healing of wound occurs where lymph dries into a crust on the surface of the wound, and the healing process is carried on under the outer hard portition. At times a wound begins to heal by scab formation, but thick white pus is produced under the scab, and unless an outlet is made it may burrow under the surrounding skin and so enlarge the area that must heal. In such cases the use of dressings that are too strong are recommended, by which the superficial cells of the wound are killed and yet not separated from the living cells below them.

Healing of poisoned wound.—When a wound becomes poisoned, the increase of the germs in it desolves the fibrin covering and destroys many of the cells engaged in the healing process. The reaction of the tissues become too much and the inflammation of the wound is so clear that

such are always called as inflamed wounds. As a result of the destruction many of the cells are thrown out in the form of pus. In this case the pus is thin, yellowish, some times blood tinged, usually sticky, and possess a bad smell. Granulation tissue is gradually formed around the site of infection in the depths of the wound, the bacteria are gradually thrown off in the pus, and healing slowly proceeds by second intention. A certain amount of poison produced by the activity of the germs enters into the animal system through general circulation and causes the symptoms of general ill health such as a rise of temperature above normal, increased pulse rate, lack of appetite, injected visible mucous membranes, and some times disturbances of the digestive organs.

Treatment to be given to wounds after receiving first aid treatments.— When bleeding has been very profuse, it is better not to distrub the dressing for 30 to 40 hours after first aid application. This allows the blood clots to become firmly established in the cut ends of the arteries, and the risk of secondary haemorrhage which is due to the removal of dressing too early will be avoided. In other cases the wound may be dressed again the day after it is caused. The bandages are carefully removed, the surface blood clots are wiped away with clean cotton wool, and a fresh dressing is applied. Sometimes it is necessary to violate this rule to remove particles of damaged tissue to be removed or large particles of foreign materials which have escaped removal at the first dressing can be easily removed.

As a watery solution for animal application take one ounce of Sulphate of zinc and Subacetate of lead disolved in 4 pints of clean water, but this being poisonous should not be used for wounds in the mouth or to wounds in such portions as the animal will lick. Dry dusting powder should be prepared out of boric acid, starch, alum or zinc oxide with a small proportion of iodoform. Where strong antiseptic action is desired iodoform content should be increased and where more astringents are required the percentage of alum should be increased, where soothing action is needed more starch and boric acid should be mixed up in the powder. For subsiding inflammations in wounds application of Antiphlogistine is the best. The watery solutions are used for washing over wounds or syringing into the depths and are then poured over swabs of cotton wool which are kept in contact with the surface of wounds by bandages. The dry dusting powders are dusted on to the wound after it has been first cleaned by washing with some antiseptic solution such as acriflavine etc. or they may be spread on to cotton wool and bandaged over the wound. Common salt, 2 table spoonfuls to a gallon of water, should always be used for the irrigation of wounds for about half an hour daily.

Whatever method is selected one should not neglect to observe strict cleanliness of the dressings of the attendants hands, and of the bandages, cotton-wool etc. and to dress the parts regularly once a day until the cavity of the wound has filled up the level of the surrounding skin. Other points that should be noted are that the stitches should be removed if they commence to suppurate and in any case they must be removed after a week; that if pus burrows under the skin surrounding a wound it must be given a drainage by incision below the level by drainage tubes or by setons; that if the proud flesh or granulation tissue rise to a higher level than the surrounding skin, it must be repressed by cautery with a crystal of sulphate of copper or nitrate of silver; that in the cases of injury to the special parts such as the eyes, nostrils, lips, genital organs, feet etc. should be left to the care of skilled advice.

(Reference from Dollar's Surgery J. J. O'conner and W. C. Miller, Veterinary dictionarium.)

OUR EDUCATIONAL TOUR

BY MR. K. S. KRISHNA RAO, IV YEAR

The value of educational tours is immense. To the students of agriculture like us such tours are highly instructive. They give us a chance to observe cultivation carried on in the different tracts of the province, under different conditions. A study of the methods followed at the various Government Experiment Stations is interesting. An opportunity is given to us to see the actual working of the different types of machines which we do not find on the College Farm. That breadth of outlook got as a result of personal observation is a real gain to us.

We had a long educational tour to the three Government Farms at Powarkheda, Adhartal and Seoni during the latter part of February, 1940. An account of this tour will speak for itself regarding the great value of such tours to the students of agriculture.

The Powarkheda Farm.—This is the main wheat growing farm of the province and represents the open field system of wheat cultivation. Out of a total area of 527.78 acres, 323 acres are under cultivation excluding a double cropped area of 8 acres. Of the area under cultivation, 247 acres are devoted to rabi crops, 37 to Kharif and 23 to garden crops. The area given to the students of the Anglo-Hindi Middle School is included in the total area of the farm. The distribution of the rabi area under various crops is as follows :—

(1) Wheat 157 acres, (2) Gram 41 acres, (3) Linseed 30 acres (4) Peas 8.5 acres, (5) Fodder crops 8.5 acres, (6) Rabi pulses 2.0 acres.

The rabi soils of the Hoshangabad tract are called Mariyar and are heavier in comparison to the Kharif soil known as "Munds". The Munds are further classified as Mund I and Mund II depending on the heaviness of the soil. The Mariyar is a clayey loam and is in its turn lighter than the soil of the Jubbulpore tract. Very heavy soils most probably the heaviest of Indian soils, occur in Narsinghpur, some of them being very soapy when moist. The Mariyar soils are characterized by the presence of lime-stone concretions.

From amongst the varieties of wheat grown in the province A013 is a very heavy yielder. It is a typical bearded wheat of the open fields of Hoshangabad tract and is a selection of the Sukkeria Pissi. It has an average yield of 577 lbs. per acre calculated over the past 23 years. It does very well in dry years but is very much susceptible to damage by rust. A085 is another selection of the Sukkeria Pissi. It is slightly earlier and slightly whiter than A013 with which it otherwise resembles. It is mainly grown on the light soils of Betul. The following are the figures of average yield of the various varieties on the farm for the last eight years.

(Figures in lbs. per acre)

Variety	Irrigated	Unirrigated	Variety	Irrigated	Unirrigated
A013	1202	577	A115	1230	507
P101	1189	530	A113	1216	...
P^8—A	1063	529	E.B. 281	...	507
Bansi	1061	...	E.B. 267	...	518
Local	1063	...	...	...	...

In the wheat spacing experiment conducted with A115 and various spacings of 9″, 12″ and 15″, hoed and unhoed after each irrigation, the best yield of 1234 lbs. per acre is being given by the 9″ spacing. Similarly in the wheat manurial experiment for the last four years, the best yield of 564 lbs. per acre has been given by cattle dung at 100 maunds per acre, urine earth at 100 maunds and castor cake at 6 maunds per acre following by yields of 464 and 432 lbs. respectively.

Almost all the Pusa wheats have been tried but they have not given very good yields. Pussa 104, 4, 12 and 101 are the only ones that have found some favour and are being grown in Chhattisgarh and Jubbulpore

tracts. Pusa 4 is the earliest maturing of all wheats and is suited for double cropping and for growing in the hilly tracts.

Cultivation of chillies.—The cultivation of chillies is another important work on this farm. The nursery is sown during the middle of May. It is better to manure the nursery with F. Y. M. than to topdress later. An area of raised beds 30' x 4' or 35' x 3½' sown with 1 lb. of seed produces enough seedlings to transplant an acre. The seed is sown mixed with ashes and irrigated twice a day till germination, after which they add 2 ounces of Ammonium sulphate or Nicifos II per 4 gallons of water used for irrigation once a week. Seedlings are ready for transplanting within 4—5 weeks of sowing.

Transplanting may be postponed at the most till the end of July but is usually done much earlier. Lines are marked out 2' apart by an argada cross lines at a distance of 1½' are drawn by another light hand drawn argada and at the points of intersection a little F. Y. M. is put to serve as a mark for planting seedlings. A set of men start making smooth holes at these places and another set of women does the planting, taking care that the roots of the seedlings placed in the holes touch the sides. If this is done properly there will be very little mortality, so that planting a single seedling in each hole can be followed.

Chillies are known to respond very well to additions of manurial nutrients and are in fact said to be difficult to rear without plenty of manure. A dressing of 200 lbs. Nicifos II in two instalments has been considered sufficient though the standard recommended dose is 230 lbs. Ammonium sulphate, 480 lbs. Super and 190 lbs. Potassium sulphate. The first dose is given about a fortnight after transplantation and the second dose about a month later. When the crop is grown under irrigation, the first irrigation is given somewhere in October and 7 to 8 subsequent ones at an interval of 3 weeks each.

In all about five pickings are obtained the second being the heaviest. The drying percentage of the ripe chillies is about 75 %. The cost of cultivation is usually below Rs. 100/- but rises to the vicinity of Rs. 115/- if the standard manurial dose is given. The average net profit is nearly Rs. 60 to 80/- per acre. The following are the average yields in lbs. per acre of chillies grown under irrigation calculated over the last 4 years on the farm. (1). Pandhurna 1381, (2). T—34 .1271, (3). P. K. 12-A 1215, (4). T—41 1156, (5). Kopergaon 766.

We were told that the Murda or leafcurling disease of chillies is supposed to be caused by trampling the soil when too wet. Stopping of

irrigation and removal of topshoots is said to do a good deal in reducing the damage.

Adhartal Experimental Station.—There are four sections of the Adhartal Experimental Station viz. Richhai, Richhai Garden, Kheri and Adhartal sections. We visited only Kheri and Adhartal sections. These represent the typical Haveli or bunded cultivation.

We visited the Steam Tackle at work at Jamoda, a village about 16 miles away. We were told that it had been bought in 1927 for Rs. 80,000/- It consists of two engines each weighing 20 tons and a four bottom plough weighing 3 tons. Each plough bottom is 14″ wide so that the working breadth of the machine is 4' 8″. The plough is hauled alternately by one of the engines by means of a steel wire cable wound around a drum rotating in a horizontal plane. The plough can work the soil to a depth of 10″. If the fields are big enough to enable the whole rope of 450 yards to be used, the plough may do even 14 acres a day while if fields are very small as little as 4 acres may even be a day's work. In the month of March and April the output of work is more. The machine has up to now ploughed some 5,000 acres. The minimum area that is accepted for ploughing by the steam tackle is 50 acres and the charge at present is Rs. 9/- per acre. Initially the charges were Rs. 17/- which were later raised to Rs. 25/- but now they have been specially brought down. The working costs per day amount to about Rs. 7/- as follows:—2 drivers, 2 firemen, 2 ploughmen, 4 cartmen supplying water and coal, 1 extra ploughman and one supervisor. The consumption of coal is about 8 maunds per acre. In addition to the above the cable requires to be replaced every third year or after ploughing 1,500 acres. With good demand nearly 900 acres can be done in one season. The shares are replaced every year but they may be sharpened and used for about two month's more.

On the Adhartal Farm we saw an electroculture experiment being conducted on three varieties of wheat viz. A090, A115, P52. Seed sparked for 1 minute and seed soaked for 4 hours and sparked for 1 minute were being compared with unsparked seed in small plots. This is the first year of the experiment and so no results were given to us. There was not much difference in the growth of the electrically treated plants and the control plants which could be visible to the eye. We were also shown attempts being made to grow rabi groundnut and cotton. Both these were not proving successful.

We were then shown the Kheri Farm—wheat varietal and manurial experiment (1938—39) being conducted on the Adhartal Farm, regarding

the effect of 15 lbs. nitrogen as Ammonium Sulphate and Nicifos II sown with seed on five varieties viz. A090, A115, P4, P528, P101. The results as published in the Nagpur Agricultural College Magazine Vol. XIV No. 1 and 2 (Page 19) and No. 3 (Page 71) were given to us. We were also given the characteristics of the various wheats of the province as published in the Nagpur Agricultural College Magazine Vol. XIV No. 3 (Page 74).

Military Dairy, Jubbulpore.—At the time of our visit to the Military Dairy the animals were suffering from an attack of foot and mouth disease. We were told that they were being treated with a solution of Bleaching powder 90 grs. in 100 lbs. water. The same water is used for drinking. The mouth is also syringed 4 to 6 times a day according to the severity of attack. A paste of equal parts of Boric acid and bleaching powder is applied to the sores twice a day. These things prevent maggots and the treatment is very efficient.

We gathered the following figures about the milch herd there:—

Item	Buffaloes	Cross breds	Country breds
Number in milk ...	131	32	31
Lactation period (days) ...	152	130	97
Average milk yield per day (lbs)...	15.7	21	12
Average weight (lbs). ...	1200—1400	1000—1200	800—1000

There are four scales of rations named A, B, C, and D. Scale A is given when no green fodder is available. In this buffaloes get 8 lbs. Cross breds 7 lbs. and Country breds 5 lbs. of concentrates as basic or maintenance ration in addition to production ration at 1 lb. of concentrates for every three lbs. milk produced. In the B Scale when green fodder is available as was at the time of our visit the animals got 6, 5 and 2 lbs. concentrates respectively. Scales C and D consist in feeding all green fodder and are not usually fed. The following represents the feeding policy:—

		Lbs. Hay	*Lbs. Berseem*
1. Milch herd—Cross breds	...	11	80
Country breds	...	10	70
Buffaloes	...	14	100
2. Down Calvers—Cross breds	...	11	80
Country breds	...	10	70

	Buffaloes	... 14	100
3.	Dry herd—Cross breds	... 11	80
	Country breds	... 10	70
	Baffaloes	... 14	100

In addition to the above the milch herd get 1 lb. of concentrate for every 3 lbs. of milk produced. The amount of milk obtained per day at present is 3,200 lbs. Buffalo milk is standardized to 3.7% fat and milk is sold at 8 lbs. a rupee.

We were then shown the Cattle dip usually called "The Bath." It was 12 feet deep and could hold 7,400 gallons. The animals are given this bath once in every two weeks. One end of the dip is made smooth and sloping while the other end is provided with steps. The animal to be "bathed" is brought from to the smoothened end and driven in when it slips headlong into the dip, swims a small distance to the other end and climbing over the steps, comes out "bathed." The bath kills all ticks and parasites on the body and is the best remedy to control them. Formerly they were using cooper's Cattle dip which is used in the ratio of 1: 250 but now they are using Young's lotion which is used at the rate of 1 part in 400 parts of water.

As regards the fodder supply they have 700 acres cultivated land at Jubbulpore where they grow Berseem, Lucerne, Rhodes grass, Guinea grass, etc. They have also got about 2,000 acres grass area. Cattle are grazed on the grass area all round the year except during the rains when they are kept on the hill. The first cutting is made into silage and the second into hay. About 5,000 lbs. of dry fodder are obtained per acre. One extra-ordinary thing we were told was that clover was yielding something like 1000 to 1200 lbs. of seed per acre at Jubbulpore and that it was available @ -/6/- a lb.

At the Dairy they have got fifteen katcha pits 30' x 12' x 6' each which are used as silos in addition to 6 concrete under-ground silos. From the grazing area they obtain 80 lakhs lbs. fodder which is baled and stored. The Katcha pit silos hold 20,000 lbs. green material and the concrete silos hold 4,50,000 lbs. giving rise to about 3,00,000 lbs. silage.

We then had a look at the bulls in the Dairy. They have three Frezian, two Sahiwal and four buffalo bulls. We saw one of the Frezian bulls, Hales Afrite weighing something like 1900 lbs. We were told that this bull receives 10 lbs. concentrates per day. On the Dairy Farm the bulls are given an interval of at least 48 hours between two services.

The Dairy building is situated on a hillock and the milk from the milking platform is brought in by trollies. The entrance is provided with a set of two spring wiregauze doors and the milk delivery window is also similarly protected against entrance of flies. In the main dairy room the things that struck one at first entrance was a huge glass lined pasteurizer in one corner, the automatic bottle filler and the sealing machine. There were also a big barrel churn, a cream separator and a refrigerator machanism. The glass lined pasteurizer holds 600 lbs. of milk and the milk is held at 145° F for half an hour after which it is cooled, bottled and stored. We were told that it was purchased for Rs. 3,000/-. We were also shown the working of the automatic bottle filler and the sealing machine using only a disc of lead-foil.

We were finally taken to see the grass baling machine. It was "McCormick Deering Hay Pressing Machine" which required a 6 H. P. engine to drive it. It requires 16 people to attend to it. When at work 6 men (2 feeders, 2 pressers and 2 balers work at the machine) work on the sides of the machine while the rest bring grass from carts to the machine. The output of the machine is 60 bales per hour. Each bale is a cube of about two feet sides and weighs 82 lbs. The bales are bound with wire.

We then saw the Hay stacker machine lying in the barn. It is called "Roberts Patent Preminer Elevator." It is worked by a pair of bullocks and can stack about 40,000—60,000 lbs. hay per day depending on the height to which it is raised. The hay stack is usually prepared with a base of 80' x 35.' The standards are 40' x 20' and 15' high. On the top of this the eaves come and the final height is about 51 feet. On finally sinking the height becomes 25 feet and such a stack will hold about 1,25,000 lbs. hay depending on the quality of the grass.

Seed and Demonstration Farm, Seoni.—The area of the Seed and Demonstration Farm at Seoni is 170.13 acres out of which 139.59 are cultivated, excluding 15 acres under irrigation, 27.09 grass land and 3.45 acres roads bunds, etc. It is one of the most paying Government Farms in C. P. Thus we were given that the average profit for the last 12 years was Rs. 2600/4/5 i.e. working out to about Rs. 20/5/- per acre. The main crops on the farm are sugarcane and vegetables including chillies, beans, tomatoes, cabbages, cauliflowers, brinjals, onions, garlic, Knolkhols out of which tomatoes are the most paying. This farm is an excellent example of how cultivation of garden and vegetable crops may be made paying on account of its situation i. e. being on the Nagpur—Seoni Road. There is a good demand and it involves little trouble in marketing the produce.

Another interesting thing that we saw was the Tuffan furnace invented in the U. P. It is claimed that this furnace consumes 15% less megasse than the ordinary Sindewahi furnace.

There is nothing particular about it except that it is at least a foot deeper than the Sindewahi furnace and has no gratings. The feeding hole is near the mouth. The time required for boiling a pan of juice in the furnace prepared at the Seoni Farm was 3½ hours while the ordinary furnace takes nearly 2½ hours.

Regarding cultivation of wheat we were told that they were trying the Raipur hybrids. No variety has been found to be significantly superior to the stock wheat of the farm i. e. A115. X 511 seems to be a promising hybrid giving a yield of 866.7 lbs. per acre on comparing with A115 giving 686 lbs. per acre. This hybrid has proved to be quite as resistant to rust as A115. These figures have been calculated only on basic yield on an area 0.15 acres. Cultivation of wheat on the Seoni Farm is done at an average profit of Rs. 10/7/7, the cost of cultivation and return per acre amounting to Rs. 16/14/2 and Rs. 27/5/9 respectively.

Extracts

THE IMPROVEMENT OF COTTON VARIETIES IN INDIA

H. G. Wells started his famous "Outline of History" with the nebulae that existed before the solar system. The present writer could not, if he would, go back so far. Nevertheless, by our little human standards, the cotton plant has been on the earth in the wild state for very long time. Truly wild species of cotton are found in all continents except Europe. All these wild species and all the more primitive forms of the cultivated species are perennial, and it is only in historically recent times that annual types have become the backbone of cotton cultivation.

Probably the oldest authentic evidence of the use of cotton is to be found in the fabric unearthed by archaeologist at Mohenjo-daro in Sind, some 200 miles from Karachi. This fabric was found adhering to the lid of a small silver vase, and the action of the silver had helped to preserve the cotton which would otherwise inevitably have perished. The fabric was examined at the Technological Laboratory, Matunga, and proved to be cotton. It is thus certain that cotton was in use in the Sumerian

civilization of Mohenjo-daro about 3000 B. C. The cotton is like some of the very course cottons of the present day.

After that there is a long gap. In early literature there is little mention of cotton, the earliest date on which we have a definite reference being about 800 B. C. It seems that Greek travellers and others had by the beginning of the Christian era given fairly vivid pictures of India as cotton-growing and cotton-manufacturing country. About A. D. 1290 Marco Polo, the famous Italian traveller, described the production and manufacture of cotton in India.

To improve the quality and extend the cultivation of Indian cotton, the Court of Directors of the East India Company secured the services of twelve American cotton planters who arrived in 1840 and were distributed to various parts of India. From the American cotton seed which they brought with them and planted, have finally sprung some of the American varieties now in cultivation in India, such as Dharwar-American (or Saw-ginned Dharwar). This Dharwar-American also found its way into the Punjab, and from it have been selected certain of the improved types of American cotton now in cultivation in the Punjab. Other improved Punjab types are believed to have a different origin (i.e. from the so-called "Narma" cotton, remnants of American cotton seed of a different importation). Another important cotton of American type is "Cambodia", obtained direct from French territory of that name in 1905. As is well known, this has become important in Madras and in certain other areas.

The Provincial Agricultural Departments, which took their present shape about 1907, devoted much time to the improvement of Indian cotton and several of the larger States did the same. A landmark in the history of cotton improvement in India is the Report of the Indian cotton Committee in 1919. This Committee went thoroughly into the requirements and state of progress of cotton improvement in each Province and State throughout India and made most valuable suggestions for future work.

Indian Central Cotton Committee.—One of the results of this report was the passing of the Indian Cotton Cess Act in 1923 and the consequent setting up of the Indian Central Cotton Committee. This body, representing all cotton interests throughout India, and meeting twice a year (generally in Bombay but sometimes in important cotton centres outside Bombay) has had a continuous record of usefulness. This Committee has had a stimulating effect on cotton improvement in a variety of ways. In the first instance, it has liberally financed research

work not only on the production of new and improved varieties (though that has been the main line of work) but also on the study of pests and diseases, on seed distribution and on the investigation of marketing and the costs of production, secondly, it has functioned as a means of sifting, criticising and correcting schemes for scientific and other work, and in this activity all the elements of the Committee have taken their full share. Thirdly, it has looked ahead and tried to foresee developments and requirements and to organize the work of the scientists accordingly. Fourthly, it has been instrumental in helping on useful legislation concerning cotton. The Indian Central Cotton Committee has also undertaken the greater part of the finance of the Institute of Plant Industry at Indore, and valuable work has been done there on the study of the inheritance of various characters in cotton, and on cotton cultivation and its problems. The Committee also maintains the Technological Laboratory at Matunga, where research on cotton technology is carried on. The fibre and spinning tests made at this Laboratory indicate at an early stage the suitability or otherwise of new strains.

The excellent research work that had been begun before the Committee came into being has therefore been much intensified. This is no reflection on what was done before it started, such as the early work of Gammie and others (in Bombay), Milne (in the Punjab), Henderson (in Sind) and Leake (in the United Provinces).

We may now deal with a few of the lines on which cotton improvements have taken place, and the first and most important of these is the production of better races of the cotton plant by means of plant breeding.

Plant breeding.—It may not be out of place to give a short summary of how plant breeding is carried out. The crop as grown by the cultivator is in most cases the raw material for the plant breeder's work, and the first process he applies is the one called selection. One plant differs from another and he picks out those which seem to have the qualities he is looking for, and from them he breeds better races. This sounds simple, but is far from being so. A plant that seems better may be only accidentally so on account of its favourable position in the field or on account of some favourable accident at the time of sowing or on account of escape from insect attack. This is the reason why plant breeders never mix the seeds of their selected plants. They follow the progeny of every single selected plant through several generations, keeping it quite pure and from time to time they reject those which are not up to standard or are breaking up into several types. At last the plant breeder arrived,

at a stage when he has one or more so called "pure lines," to each of which he has given a letter or number or combination of these. To keep seed pure it is necessary to prevent the flowers from opening and being cross-fertilized by insects. Cotton breeders use a number of ingenious devices for this purpose. One sews the petals of the bud together, another puts a little ring of wire over the bud, and still another seals the bud with wet clay.

The next stage is the testing of these pure lines against the local variety which they are to replace and against one another. This again appears simple but is actually difficult, and a whole technique of field experiments is employed, based on the mathematics of probability (the same kind of mathematics as used by actuaries). Generally, before the final stage and along with the last years of field experiment, parallel experiments are carried out on the field of cultivators so that the end result may be more reliable and the more rigorous conditions of actual farming may be allowed full play on the races under trial. After such experiments a single pure line is chosen and this is then multiplied and distributed. It sometimes happens that selection is not enough. Something is missing from the race that has been evolved and must be added. The plant breeder does thus by crossing the race with another which has the desired character and then continuing his selection among the hybrid progency. A striking example of this is the history of the now well-known Jaywant cotton. About 1913, the Cotton Breeder at Dharwar had produced a pure line called Dharwar I. This was a race which gave an increase of 10 per cent in yield over local Kumpta, an increased ginning percentage of 13 per cent., and a greatly increased value in rupees per candy. At the height of its popularity this strian of cotton covered 160,000 acres in the Southern Mahratta country. But, when cotton wilt showed itself as a serious disease about 1920 this otherwise excellent cotton proved susceptible to the disease and, if no remedy had been found, would have been wiped out. But the Cotton Breeder had among his other pure lines one (later called Dharwar II) which proved to be very wilt-resistant, and he crossed it with Dharwar I. From the progeny of the cross, he finally produced, about 1926, the race which the present writer, in 1930, named Jaywant (victorious) in celebration of its victory over wilt.

It will be seen from the above that plant breeding is a slow process, and needs continuity over years in order to produce results.

Results obtined.—Let us consider a few of these results in other parts of India. It is impossible to deal with what has been done in all

Provinces and States so that only a small typical selection of achievements can be mentioned. Here are some of them.

In the Punjab, one of the earliest successes was the breeding of the 4F variety of American cotton. This is a rough-leaved Upland American type selected from the so-called Narma cotton. i. e. the early introduced American cotton (not Dharwar-American). Its ginning percentage is 32, and when unmixed, its staple is $\frac{3}{4}$ to $\frac{7}{8}$ inch, fairly strong and regular. The longest and finest of the Punjab-American cotton varieties is 289F with a staple of one inch to one and a thirty-second inch. A sub-selection from this made on the estate of the British Cotton Growing Association of Khanewal, with a higher ginning is now called 289F/K25. Another selection, viz 289/F43 is also very popular in certain parts of the Punjab. It is early maturing and resists drought and Jassids. From 289F was also derived the variety now known as Sind Sudhar, which is a strain selected in and suited to Sind conditions with a staple of one inch and a ginning percentage of 29. The area under this is rapidly increasing. Cotton development in Sind was made possible by Sukkur Barrage. The Indian Central Cotton Committee is now financing new research intended to produce still longer staple cotton in Sind, using for this purpose all the varied knowledge now at our disposal and bringing in varieties likely to be used for crossing from other parts of the world.

In the Punjab, deshi cotton has also received attention, and one of the recent successes there is the strain which has been called Jubilee (from its having been first distributed in the year of late King George's Silver Jubilee). This strain is a cross between Punjab Mollisoni and Chinese Million Dollar and has a staple length $\frac{7}{8}$ inch and a ginning percentage of 34. The selected desi cotton variety Mollisoni 39 is very popular in the Central Canal Colonies.

In the Bombay Presidency a recent success is Jarila, which is the name given to a cotton selected from the Verum sub-section of the species Gossypium neglectum, a component of the old "Khandesh mixture". Jarila is a medium-stapled cotton of short season suitable for the replacing of the short staple cotton in Khandesh.

Some good work has been done in both Hyderabad and Mysore States. In Hyderabad some of the Gaorani selections are outstanding and in Mysore there is a line of cottons, the so-called M. A. (Mysore-American), which have very good qualities. In the Central Provinces the outstanding success has been the Verum cotton which now has a standing all of its own. In Madras, striking success has been obtained in the production of Co. 2, a selection from Combodia with a one-inch

staple, and there is a lot of work going on there in other types with successes in several directions. One or two special directions in which plant breeding has been a success and in which the most modern scientific knowledge has been utilized are worth mention. One of these lines is the discovery of how to get cotton plants absolutely immune to cotton wilt. Wilt-resistant strains evolved by the ordinary plant breeders' method are never entirely free from wilt-affected plant and the percentage of such in a bad season may be considerable. A special technique based on our knowledge of heredity and on a process which permits of maximum infection, weeds out all the plants except those which are completely immune. On the basis of these few can be built a completely immune strain.

Another recent fascinating line of work is the production of new races from the crossing of old American and Indian cotton varieties. For years this was considered impossible, and the reason was known, i. e. important differences in the structure of the cells that carry the hereditary characters. Recently, however, the employment of a drug called colchicine has made it possible to get fertile seeds from crosses of American and Indian cottons. Research on this matter is being carried on mainly at Surat and is being financed by the Indian Central Cotton Committee.

Improved cultivation methods.—Improvement in the actual cultivation methods used in cotton-growing has always been one of the tasks of Agricultural Departments. Cotton varieties, cultivation methods, soil and climatic conditions vary througout India and hence the improvements have had to be adapted to the local conditions. Most Agricultural Departments are now in a position to give expert advice on such questions as seed-rate, seed treatment, green-manuring, rotational crops, and inter-tillage. In irrigated areas advice is given on the nature and number of waterings and some excellent work has been done on this subject, both in the Punjab and Sind. In the Punjab an investigation is now going on (financed by the Indian Central Cotton Committee) to discover the causes of the much dreaded cotton "failure" which occurs in certain years when bolls open badly and the seeds are empty with little useful cotton on them. This appears to be largely, though not entirely, determined by soil conditions, and it may be that some system of manuring or soil treatment will be a protection if not a remedy. The growing of other crops, such as pulses, between the cotton rows and alteration in sowing date seem to reduce considerably the attack of cotton root-rot in the Punjab and these discoveries may lead to useful modifications in cultivation practices.

Cotton insect pests have received much attention from scientific research workers. In the case of the spotted both-worm, it is now proved that the early uprooting of the cotton plant after harvest, so as to leave the ground completely free of cotton for a few weeks, greatly reduces the attack. Measures to popularize this useful practice have been taken in Bombay and the Punjab. In Hyderabad State the spotted both-worm also hides in the soil and so different technique has had to be devised there. As regards the pink boll-worm, it is proved that heat treatment of the seed reduces its attack. Jassids are the most troublesome insect pests at present. These are insects which suck the juice out of the green parts of the plant and reduce its strength. The most promising line of defence seems to be the breeding of Jassid-resisting strains and this is being attempted.

The Indian Central Cotton Committee is continuously watchful of all requirements of Indian cotton cultivation throughout the whole of India and at various times has made a comprehensive survey of the whole position. A very important meeting was held in 1939 when a special sub-committee dealt with the present position and future prospects of Indian cotton. The emphasis laid by this committee on the improvement of the efficiency of cotton cultivation has resulted in the financing of certain so-called " projects " in which a whole series of improvements is being "putacross" as system of agriculture affecting not only cotton but also all the crops grown along with it or in rotation with it, in compact groups of holdings or preferably in complete villages. A typical project of this type to be carried out in the Central Provinces involves the following improvements :—

(1) Land development (drainage, embankment etc.)
(2) Building up soil fertility (composting etc.)
(3) Rotation of crops with groundnut and jawar.
(4) Use of improved seed (Verum 434 cotton, Groundnut A. K. 12-24, Bansipalle wheat).
(5) Improved method of cultivation.
(6) Introduction of diversified farming (i. e. inclusion of animal husbandry).
(7) Introduction of subsidiary industries.
(8) Organization of cultivators on co-operative lines.

A word or two must be said about cotton seed distribution schemes. It is no use breeding a good variety of cotton if the cultivator cannot get the seed in large quantities, hence these schemes have been devised and put in action in various Provinces and States. Any seed scheme has the following essential stages :—

(1) The plant breeder's plot where he produces a small amount of absolutely pure seed.

(2) The Government farm where this seed is multiplied in a pure state.

(3) The Registered Growers—responsible cultivators who agree to grow on this variety and allow the Agricultural Department to "rogue" it (i. e. purify by uprooting all plants not true to type).

Thereafter the seed goes to reliable agents who get some commission on the sale of these seeds. The Agricultural Department often undertakes the collection of indents and orders for such agents. A system like this needs a lot of attention on both the technical and the financial sides. Where well managed, such schemes have caused a rapid extension of valuable new varieties and a consequent increase in income to the cultivator.

In current speech we often hear of a subject being attacked on a "wide front." That certainly is the case with cotton improvement in India. The attack has not diminished since it received a stimulus with the establishment of the Indian Central Cotton Committee, but continues in many directions, carefully watched and scientifically guided. We may expect news of further improvements in yield, in staple length, in ginning percentage, in disease-resistance and in farming practices.—*Indian Textile Journal 1890—1940 Jubilee Souvenir*).

MEEK—GREGORY REPORT

American Market for Indian Manufactures

What producers should do

"Made in India," A Selling point

(The report of Dr. Gregory and Sir David Meek, who were sent by the Government of India in July last to the United States of America to investigate the extent to which it would be possible to find markets there for exports excluded from Europe as a result of the blockade, was made available to the Government at the end of October).

The main conclusions of the report are as follows:—

(i) The economy of the U. S. A. is at present in the phase of recovery from the depression of 1938. This recovery has been brought about in

part by the generally favourable business situation reacted by the earlier phases of the war, in part by Allied orders and in part by the anticipation that the vast expenditure contemplated under the armament scheme will react favourably on business. It is not reasonable to assume that, unless some unforeseen set-back takes place, the national income of the U. S. A., at present running at some 75,000 million dollars per annum, might under the circumstances of full armament activity, run at the level of some 80,000 million dollars.

(ii) In these circumstances, the normal movement of imports in the U. S. A. should be maintained and there should be some expansion as the aggregate income of the country expands. In addition, under the direct impulsion of the armament drive, there should be an expansion of the demand for products for stock-pile purpose and for armaments manufacture. In this connection manganese ore and mica are of particular significance, but other commodities, referred to in detail in the report, may also be affected.

Shipping difficulties.—(iii) In considering the export situation from India to the U. S. A. account must be taken of shipping difficulties. In this connection the inaguration of a new line between the two countries has improved matters appreciably, to judge by the opinions expressed in the U. S. A.

(iv) There is a growing interest in Indian consumers' goods, such as cotton prints, druggets etc. "Made in India" is itself a selling point and anti-Japanese prejudice on the part of a certain consuming section should assist the sale of Indian products. On the other hand, since a considerable proportion of the total sale of consumers goods takes place through large-scale organisations it is imperative that Indian producers and merchants should pay regard to the special character of the American market. Variety, novelty, strict adherence to the specifications laid down, promptness of delivery, are essential.

(v) There is considerable reason to suppose that trade could be promoted if Indian businessmen were to visit the U. S. A. more frequently and were to make personal contacts with actual or potential buyers. Moreover, in view of the aggressive attitude of the producers of competing goods, such as paper-bag makers, it is necessary to promote interest in Indian products by the preparation of pamphlets and other propaganda material setting out the merits of the products it is intended to sell, the terms on which they can be obtained, etc. This is a work which must be undertaken by business men themselves and cannot be undertaken by Government agencies.

(vi) Whilst the analysis of the position of individual commodities contained in the Report shows that in a certain number of cases expansion of importation is possible, thus providing new markets for products excluded from European markets, and whilst further armament expenditure is certain to increase the demand for certain special commodities, it is not possible for India to look to the U. S. A., as an effective substitute market for the entirely lost European markets.

With regard to the sixth of these conclusions, the position of all commodities the exports of which no European countries before the War were of any significance was examined. These commodities, it may be pointed out, were primarily raw materials, some of which are largely produced by the United States itself and some of which enter into direct competition with American products Complete substitution of the American for the European market is thus not easily possible. But a review of the findings on the various individual items make it possible to divide them into three groups.

Three groups.—The first consists of commodities of which it can be said that no problem of disposal arises owing to abnormal war demands in India or abroad or to other special conditions. These are tanned skins, raw rubber, pig iron and chromite.

The second group comprises commodities of which Indian supplies would have to face competition from production within the United States itself or in the Philippines or in South American countries, in the welfare of which the United States is specially concerned, as evidenced at the recent Havana Conference and which apart from this have, in some cases, long-established connections with that country. Commodities in respect of which such competition is so effective as to leave little hope for expansion of Indian exports are the whole group of oilseeds (including groundnuts) and oilcake; raw cotton and cotton waste; raw hemp; raw hides; wheat; bones; bone manure and bone meal; lemon-grass oil.

The third group represents Indian exports the prospects of which in the U. S. A. are such as to warrant special attention being paid to them: these are jute goods, raw wool, raw skins, mica, coffee, tea, lac, coir manufactures, myrobalans, cashewnuts, kapok, cardamons, pepper and ginger.

The report does not suggest that the potentialities of the U. S. A. as a market for Indian goods is confined either to "munitions" raw materials or to certain staple Indian products. On the contrary, the authors of the report attach much importance to the cultivation of the American consumer market for manufactured goods and in this connection

the attention of manufacturers will be drawn to the conditions under which alone, in the opinion of authors of the report, contact can be successfully established with American buying organisations. (*Indian Information, December 15, 1940.*)

CONTROL OF CONTAGIOUS MASTITIS

Control not difficult.—It is possible to control mastitis by quite simple measures. Every farmer can keep the disease down to a small amount by practising a few simple precautions which cost nothing except a little trouble. In farming, as in other pursuits, it is the little bit of extra care that makes the difference between the successful and the unsuccessful man.

Control methods depend on finding out, so far as possible, which cows are infected, and so organising the herd management routine that no opportunity occurs for the infected cows to infect the healthy animals. It is essential to understand that the form of mastitis which can be controlled is catagious, and if neglected may run through a whole herd.

Detecting the disease.—Careful feeling of the udder immediately after milking will detect hardening of the udder tissue in about 10 per cent of the cases, where infection is not obvious, owing to visible changes in the milk, e. g. clots.

Testing the foremilk from each quarter with brom-cresol purple paper will detect about 50 per cent of the infected quarters, but also give a few false positives, i. e. a few uninfected animals will give a purple colour with brom-cresol purple.

Four pieces of the brom-cresol purple paper should be held fan-wise in the left hand, and milk from each quarter, in turn, allowed to fall upon a piece. Normal uninfected milk gives a dove-grey colour; a purple or purplish grey indicates mastitis. Late lactation milk gives a navy blue colour with brom-cresol purple but usually all four quarters give this colour.

Weekly tests.—In any case the farmer will know which cows are drying off so that he will not be misled by this. Brom-cresol purple tests should be done every week.

The strip cup be used to receive the foremilk (two squirts from each quarter), before every milking. Clots or flakes in the foremilk are a reliable indication of mastitis, but only detect about a third of all cases of catagious mastitis.

A sudden fall in yield, otherwise unaccounted for, is almost certain to be due to mastitis. Milk recording is, therefore, a valuable help in the control of mastitis, and it pays to watch the record sheet carefully.

As regards the control of mastitis it is suggested that the farmer should place all suspected animals in a seperate shed or on one side of the shed. If possible, have separate stools, pails and milkers for the infected animals. Another precaution which it may pay to take is to arrange to milk the cows in both clean and infected portions of the herd in order of age, milking the heifers first and the oldest cows last. Wash down the udders with cloths previously held in a weak disinfectant. A suitable method is to keep a one-in-five strength chloros solution in a stone jar in the cowshed and to add one eggcupful of this to a bucket of water. Change the water after attending every half-dozen cows.

Washing is essential.—It is essential to see that every milker washes his hands before milking each cow. Examine the udders, and especially the teats, carefully at each milking. Again one should remember to treat all abrasions, cuts and sores with a healing ointment in good time.

If milking machines are used, carry out the makers' instructions in detail. It is best to dispose of the infected cows when opportunity occurs, starting with the worst cases. When buying in the new stock get the milk bacteriologically tested if possible. Otherwise carry out the three tests described. Finally, successful control of this disease needs the best possible herd management, taking particular care that stripping is properly done and avoiding over-stocking.—*(The Farmer & Stock-Breeder.)*

THE ASSOCIATION FOR THE ADVANCEMENT OF RESEARCH IN AGRICULTURE AND ALLIED SUBJECTS

The idea of organizing such a Society was first moved by Dr. R. H. Richharia, M. Sc., Ph. D., Oilseed Specialist, when he convened a meeting of those interested in the subject on the 29th November 1940, in the V. T. I. Building. Rao Bahadur D. V. Bal, M. Sc., (Agr)., Agricultural Chemist to Government, C. P. was elected to the Chair. Dr. Richharia then emphasised the desirability of organizing such a Society with the following words:—

"It is said that 'whoever can make two ears of corn or two blades of grass to grow upon a spot of ground where only one grew before deserves better of mankind and does more essential service to his country than the whole race of politicians put together.' It is with this object in view chiefly that Agricultural Research is being financed everywhere. This does not necessarily mean that the plant breeder occupies the premier position in agriculture. His position is no doubt, very great, but the position of Agricultural Experimentalist, Engineer, Chemist, Mycologist

and Entomologist is, in no way less important. It is with the co-ordinated efforts of all these research workers that the maximum crop can be produced per acre. The story does not end here. The problems of live-stock are perhaps even of greater importance and require immediate solution. Once the problems are solved they are to be presented to the cultivators in their own fashion. How can this be achieved most effectively and impressively? Not by individual, but by co-ordinated efforts. The state can only establish and finance a particular research section but cannot lay down any rigid rules how the various sections should work shoulder to shoulder. It is the joint responsibility of the research workers themselves to place before the Government, in one continuous story or account the material to be circulated among the villagers for their uplift. There are various methods followed in different research institutes to carry out this programme, the most important of them being the holding of occasional meetings, where, by turns research workers from different sections read out papers on the work being carried out by them or done elsewhere.

The advantages of having such an organization where the activities of the various departments are co-ordinated are self-evident. One would be able to know what problems are being tackled in more detail.

It is, therefore, now high time that we should form an active association to carry out effectively this part of our responsibility.

After some discussion it was decided to formulate such a Society with the above name. The following items were discussed and passed :—

(1) All the 28 gentlemen who were present were declared as Foundation Members.

(2) Elections :—

President :—Rao Bahadur D. V. Bal, M.Sc. (Agr.) (Hons.)

Secretary :—Dr. R. H. Richharia, M.Sc., Ph. D.

Joint Secretary .—Dr. V. G. Vaidya, B. Ag., Ph. D.

(3) A Committee consisting of Rao Bahadur D. V. Bal, Dr. R. H. Richharia, Mr. J. F. Dastur, Dr. G. S. Bhatia and Dr. V. G. Vaidya was formed to draw a constitution for the Society and for presenting it to the General Body.

The first meeting of the Association was held on the 8th March 1941 in the V. T. I. Building when Rao Bahadur D. V. Bal, M.Sc., (Agr.), Agricultural Chemist to Government, C. P. read a paper on "Periodic fluctuations in Carotene content of cow and buffalo butter fat." An interesting discussion on the paper followed.

College and Hostel Notes

The period under report marks the busiest time in the year. The students were engaged in studying for the examinations. Hockey, Tennis and Volley-Ball continued to be played. Mr. R. S. Raghuwansi of 3rd year won the second prize in the three mile running race at the Nagpur District Games Tournament. He has also distinguished himself in the University Sports by being first in the three mile race and third in one mile race. For his fine performances he has been awarded the College colours and was declared the Champion Sportsman of the year 1940-41. We congratulate him for the same.

EXAMINATION RESULTS 1940-41

B. Sc. (Agr.) Examination, Nagpur University

First Division

R. P. Jyotishi*

Second Division

Babulal Nema
B. C. Pradhan
D. K. Sohoni
K. P. Lele
K. J. Deshpande
K. G. Bhide
K. S. Krishna Rao
M. W. Khankhoje
M. K. Oka
M. K. Shingarey
M. J. Khare
P. V. Deo
R. N. Bhargava
R. S. Chauhan
S. A. Joshi
S. L. Shrivastava
S. S. Khokle
S. K. Gangrade
S. L. Patni
V. R. Deshmukh
V. V. Gokhale
V. L. Golhar
W. P. Sole
Y. M. Mokashi

Third Division

Mohamed Shoaib
A. D. Kane
K. A. Bhandarkar
M. H. Huddar
M. V. Lele
P. S. Thakur
R. S. Mehta
S. P. Chitnavis
S. L. Gadwe

Pass

H. N. Soni
P. K. Mukerjee
B. T. Wankhade
G. U. Patankar
G. D. Hishikar
S. N. Joshi

---

* *Awarded Sir Arthur Blennerhassett Memorial Medal* and *Chakradeo Memorial Medal* for standing first at the B. Sc. (Agr.) Examination of 1941.

INTERMEDIATE EXAMINATION IN SCIENCE (AGRICULTURE)

First Division

P. S. Parsai*
D. D. Shukla
D. N. Kherdekar
B. L. Nayak

Second Division

A. P. Gupta
G. S. Pawar
B. B. Vyas
Laxman Pandey
C. S. S. Mudaliar
M. S. Puranik
D. L. Potfode
M. S. Sonwalkar
G. R. Kokardekar
R. S. Melag
G. S. Aparajit
R. C. Jain
G. T. Saoji
S. N. Khutate

Pass

D. S. Kshirsagar
N. R. Sohni
A. P. Gumasta
P. S. Pimpalgaonkar
B. M. S. Bhuwal
R. T. Desai
N. K. Chitnavis
S. D. Deshmukh
V. D. Barve

Campartmental

K. S. Dave
C. V. Gaikwad
L. G. Kolte

**Awarded Sir Arthur Blennerhassett Memorial Medal* for standing first in the Intermediate Science (Agriculture) Examination of 1941.

THIRD YEAR PROMOTION EXAMINATION

Successful Candidates in order of merit

Jagannath Hota
B. B. Misro
J. P. Shrivastava
A. M. Deshpande
S. R. Chopde
R. L. Agrawal
R. S. Raghuwanshi
S. K. Palnetkar
G. S. Sinhal
W. R. Chaurey
K. C. Nema
R. T. Ghodimare
P. M. Ingle
Ajit Singh
W. L. Agarkar
Md. Bilal Khan
M. P. Dwivedi
P. T. Rajkondwar
M. Ganpat Rao
B. B. Banerji
S. Kifayatullah
R. G. Kelkar
S. A. Stevenson
C. L. Arzare
L. N. Malvaiya
Trilochansingh
M. G. Mohoni
B. G. Wakhale
R. P. Deshpande
R. G. Limsay
S. B. Thawale
M. Sayeedullah Khan
V. S. Barkar

FIRST YEAR PROMOTION EXAMINATION

Successful Candidates in order of merit

A. C. Jain	H. L. Patel
J. R. Kakde	K. N. Awasti
K. G. Nema	K. S. Deshmukh
M. N. Paithankar	B. G. Bhalerao
G. N. Raut	S. M. Zilpelwar
L. Agrawal	A. B. Shukla
R. R. Rawat	K. K. Kaushal
K. K. Yerawar	R. B. Mandoli
B. P. Mishra	L. P. Nayak
G. P. Misra	G. L. Dahare
K. S. Mahajan	Tyabali
R. N. Khandelwal	V. P. Joshi
V. P. Chiddarwar	Tarachand Gangrade
A. Q. Khan	G. D. Dubey
B. C. Jain	H. V. Karandikar
M. G. Chitnavis	R. M. Shendey
R. S. Maholey	B. T. Pendharker
K. B. Kannao	L. A. Patil
S. G. Kulkarni	K. G. Sahasrabudhe

To Subscribers

We are highly thankful to you for your co-operation in the past and trusts that you will extend the same in future by your continuing as a subscriber and enlisting your friends-interested in Agriculture—as subscribers.

Managing Committee.

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